MODERN SCHOOL BUILDINGS

FELIX CLAY

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MODERN SCHOOL BUILDINGS

ELEMENTARY AND SECONDARY

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SCHOOL BUILDINGS
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A TREATISE ON THE PLANNING, ARRANGEMENT, AND FITTING OF DAY AND BOARDING SCHOOLS

HAVING SPECIAL REGARD TO
SCHOOL DISCIPLINE, ORGANISATION, AND EDUCATIONAL REQUIREMENTS

WITH CHAPTERS ON THE
TREATMENT OF CLASS ROOMS, LIGHTING, WARMING, VENTILATION, AND SANITATION

BY
FELIX CLAY, B.A.
ARCHITECT

SECOND EDITION, REVISED AND ENLARGED

WITH FOUR HUNDRED & FIFTY ILLUSTRATIONS, COMPRISING THE PLANS OF 95 SCHOOLS, AND NUMEROUS VIEWS, DETAILS, & FITTINGS

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PREFACE TO THE SECOND EDITION.

The exhaustion of the first edition and of a subsequent reprint has now provided an opportunity of revising the information in this book in order to keep pace with the rapid changes in educational matters of the last few years.

A heavy pressure of other work has made it impossible to devote any considerable amount of time consecutively to the task of revision, and the writer cannot help feeling that there may be repetitions and omissions due to the necessity of continually laying aside the work for varying periods.

The first part of the book, dealing with Secondary Schools, has been little altered beyond the omission of a certain amount of somewhat irrelevant matter, and the insertion in its place of a chapter on Fire Protection and rather fuller treatment of Training Colleges, Pupil Teachers' Centres, Cost of School Buildings, &c.

The second part, upon Elementary Schools, has been practically rewritten, particular attention being given to the subject of planning small and medium sized country schools, a branch of school building that was somewhat perfunctorily dismissed in the first edition; special chapters have also been added upon Infant Schools, Manual Training, and Cooking Centres, Temporary Buildings, the Alteration and Adaptation of old Buildings, as well as a Comparative Survey, fully

illustrated, of the systems of school planning on the Continent and in America.

In both parts of the book additional plans of a number of recently erected schools have been included.

Finally, the writer would like to take the opportunity of again expressing his most sincere thanks to the architects who have so kindly and freely given both plans and information.

FELIX CLAY.

February 1906.

PREFACE TO THE FIRST EDITION.

The published information on the subject of school buildings in this country, especially with regard to those for the purpose of secondary education, is curiously deficient. The writer of this work, when joining, some years ago, a body concerned with the building and management of a considerable number of Secondary Schools, felt very strongly the want of a book dealing with the ordinary questions arising in connection with their buildings. A careful search, however, elicited the fact that no such thing existed. There was of course Mr Robson's well-known "School Architecture," but this, brought out in 1874, a period when drastic changes in tuition and in the arrangement of school buildings were in progress, has become for the most part inapplicable to the modern style of school. It is also practically confined to the Board Schools of London, and a short chapter in it, with another in Mr Robins' "Technical School and College Building," represent the literature dealing with the subject of buildings for Secondary Schools.

The present volume is intended to supply this deficiency, and while both Elementary and Secondary Schools are included, the latter have been made its principal aim. They are dealt with before the Elementary Schools, on the ground that it is more desirable that the methods of Secondary School buildings should find their way into the Elementary Schools, than that those of the Elementary School should be adopted in the Higher Schools, as has hitherto been too much the case; probably owing to the fact that the books published on school buildings treat nearly all questions from the point of view of the Board School.

The book is itself a compilation of facts and information drawn from as many sources as possible, and illustrated by actually existing buildings, for the purpose of affording the necessary data from which a healthy and convenient building may be evolved. It does not attempt to suggest the lines upon which the perfect school of the future will be planned.

In its arrangement the object has been, first, to give a general survey of the conditions under which education is carried on, with a sufficient account of the organisation and daily routine of the various kinds of schools, in order to convey an idea of the uses of the different rooms, their general requirements, and their relations to one another; and secondly, by giving the plans of a number of recent buildings, to show the different methods that have been tried to meet those requirements. Questions which affect the health of the scholars, such as lighting, warming, and ventilation, are considered at considerable length.

For much of the matter the writer is indebted to the many Head Masters and Mistresses who have been kind enough to go round their schools with him, and who made valuable suggestions as to the plan of the building from the point of view of the Principal of the school. The writer would like to take this opportunity of expressing his most sincere thanks to them, and to others who have helped with advice and suggestions, among whom the Dean of Manchester, Sir J. Fitch, Mr William Bousfield, Mr Basil Champneys, and Miss Mary Gurney should be mentioned as having given valuable aid.

The plans are in all cases, except those of schools from foreign countries, given with the permission of the architects who designed the buildings, whose courteous and ready assistance in offering every facility, both by the loan of drawings and in giving information, has alone made the production of the book possible.

FELIX CLAY.

September 1902.

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The subjoined list contains, it is hoped, all the books in English dealing with school architecture. With regard to foreign books, and those upon such subjects as school hygiene, organisation, &c., which touch incidentally upon the question of school buildings, there is no attempt at an exhaustive list; only those which have been consulted or referred to are here described.

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MODERN SCHOOL BUILDINGS.

INTRODUCTION.

The attention that has been devoted to the subject of suitable school buildings has been one of the most marked features in educational matters of recent years.

Until comparatively lately, any building was considered good enough for a school, the only consideration being its capacity to hold the required number of children. The style considered most suitable approximated as nearly as might be to a church, and most unfortunately a period of great activity in school building coincided with the revival of the style of Gothic architecture. The result of this is seen in schools of every type, from village schools to the large boarding institutions: schoolrooms or dormitories are arranged with high pitched steep roofs open to the apex, little windows nestling under the eaves, the larger windows filled up with stonework, and everywhere the dim religious light which, however suitable in a church, is sadly out of place in a school. It is difficult to estimate the harm done to school building by the long prevailing fashion of investing schools with an ecclesiastical and, worse still, Gothic style of architecture.

At the present time there is a strong and widespread desire to ensure that the school building shall be suitably arranged for its work, not only that it should be well lighted and adequately ventilated, but that it should be definitely adapted to the particular needs of the school. It is still not uncommon to hear warnings against the danger of attaching too much importance to the provision of fine and handsome buildings to the detriment of the teaching, yet there is more connection between the buildings and the work done in them than is at first sight apparent. The degree to which a well-designed school can assist the teacher in his work, save wear and tear and unnecessary trouble, and effect economy, requires experience to realise to the full.

The influence, unconscious perhaps, but still strong, that a fine and handsome building will exercise in promoting the sense of the dignity of education and in forming a standard of taste is a factor that should surely count for something.

The Board of Education issue a series of regulations for the assistance of architects engaged in school planning. These rules are prefaced by a few exceedingly useful general suggestions, and in particular there is one that should be carefully borne in mind by every one who is connected in any capacity with the building of a new school.

> "Before instructing an architect, managers are recommended to have a careful regard to the size and circumstances of the school, and to the number and qualifications of the staff to be employed."

The architect who is called upon to design a school must have a full knowledge of the life, routine, and organisation of the particular school, as well as a mere statement of the number and sizes of the classes to be provided for, if he is to produce a really successful building, one that will mark an advance in school planning, not a mere copy of some other design. This is of more importance in the case of Secondary Schools with their wide diversity of systems and methods than in the case of buildings for Elementary work, in which, to a certain extent, it is possible to use a somewhat stereotyped form. The architect who takes up school building as a special branch of work, at once finds himself confronted with the necessity of acquiring a somewhat intimate knowledge of a number of things that at first sight seem purely educational. He requires to know a good deal about methods of classification, subdivision of classes, or arrangements for special subjects, organisation and routine ; the number one master can take in a class or at practical work, the relative size of forms in different parts of the school ; if pupil teachers are concerned, the method of their tuition ; the number of those attending half time, &c.—all questions having an important bearing upon accommodation. It is perhaps when advising upon questions of additions or adaptations that such knowledge is most essential.

To a considerable extent, of course, the promoters of the scheme or the master of the school can tell the architect what they want, but, unless the designer is himself conversant with school arrangements, he will have difficulty in appreciating the points, or in knowing which are of less importance in case of necessary exclusion, or to take full advantage of the chance opportunities that may be offered by the plan.

There are many details too that would not be noticed until the plans had been more or less worked out, and it is difficult to insist upon the design being altered to meet a few small points when the necessary change spoils some desired effect in the elevations or involves a reconsideration of the whole scheme. It should, however, be remembered that the work for which a school building has to provide is so heavy and continuous, that the lack of something that seems in the first place somewhat insignificant may by the end of the year amount to a considerable inconvenience.

Again, the school architect should have a clear idea of the law and the conditions under which education is carried on, the authorities to whom plans must be submitted, procedure necessary for negotiating loans, &c., necessary preliminaries in the building of a new school—all things which may perhaps be considered to lie outside his real functions, but at the same time he will find such a knowledge of the greatest use.

The conditions under which education is carried on have of course been greatly simplified by the passing of the Act of 1902. As far as the Elementary Schools, which were under the old School Boards, are concerned, the actual difference is not great, an Educational Committee appointed by the Council which forms the Local Authority taking the place of the old School Boards. In the case of the poorer Voluntary Schools, by placing the charge for the maintenance of these on the rates, a great move in the direction of increased efficiency has been brought about. The buildings and all structural repair or additions are still in the hands of the managers, who are bound to keep their schools in a state of structural efficiency, and to make any alterations or improvements that can be reasonably demanded by the Local Authority, who in their turn have to appoint two-thirds of the managers, and are liable for all expenses of salaries and general maintenance, including such repair of the building as is due to fair wear and tear of school use.

The Voluntary Schools represent the early efforts made in this country for the education of the children of the poorer classes. During the first three quarters of the last century, and prior to the passing of the Act of 1870 for the formation of School Boards, practically all the elementary education of the country was in the hands of various denominational and voluntary agencies. The widespread supply of Elementary Schools all over the country is an eloquent testimony to the early initiative and energy of the Church. In recent years, however, the rapidly rising standard of educational requirements in the way

of buildings, equipment, teaching staff, &c., has made it impossible, except in a few cases, for schools dependent upon the support of voluntary subscriptions to keep pace with modern demands, or to come within a measurable distance of the high standard set by the rate-aided schools.

While in a certain number of cases excellent buildings have been erected by voluntary agencies, the great majority of these schools are far behind modern requirements, and all over the country are to be found, in marked contrast, admirably and splendidly equipped buildings belonging to the Local Authorities side by side with inconvenient, badly lit, ill-ventilated buildings of an obsolete type, in which education is carried on under grave disadvantages to children and teachers by an inadequate teaching staff.

The Act of 1902 remedies this as far as the salaries of teachers and maintenance of the school are concerned, so that one pressing burden is removed from the Voluntary School managers. The difficulty of the buildings, however, remains. Under the Act the Local Authorities who are responsible for the proper maintenance of the schools, with the right to ask for any improvements in the buildings that may be reasonable, have not unnaturally felt that the time when the burden of maintenance was removed from the managers was a suitable moment to ask for long-needed improvements, as well as a natural dislike to accepting the responsibility for any very bad buildings, which, having been passed by the Board of Education when the standard of buildings was far lower than at present, had been allowed to go on from year to year. The managers of the Voluntary Schools have had much difficulty in many cases in providing the funds, as they are unable merely to direct the funds previously subscribed for the carrying on of the schools ; for the donors being themselves rated for the upkeep of the school, and knowing that it is now to be carried on at the expense of the Local Authority, have not unnaturally ceased to contribute voluntarily. The consequence is that while the placing of all Elementary Schools upon the rates for their support has had a considerable effect on improving the school buildings, this has not been so rapid nor to so marked a degree as might have been anticipated. The Local Authorities also in many cases have not pressed very hard for improvements, from a reluctance to incur the cost of replacing the buildings in case their demands forced the managers to relinquish their schools.

There is, however, no doubt that the result of the handing over to the various Local Authorities the responsibility for the schools in their area, has been a large increase in activity in school buildings. An

incidental advantage of placing the control of a large number of schools in the hands of one authority, has been the appointment of special architects to deal with the schools; this specialisation is bound to result in a great advantage to the school buildings.

The following book has been divided into two parts, dealing with Secondary and Elementary Schools respectively, and it will be as well to state the grounds on which the division has been made. To define secondary education is no easy task. The Royal Commission on Secondary Education in 1896, under Mr Bryce, finally, after much deliberation, gave as their idea of it: "Education conducted in view of the special life that has to be lived with the express purpose of forming a person to live it." This definition will of course include technical education; but as such subjects as German and French come under the head of technical, the Science and Art Department recognising any subject of instruction except Latin and Greek, it is hardly possible to separate the two. For the proper carrying out of this idea of education it is essential that school should not be left before the age of seventeen or eighteen. As a matter of fact, the leaving age gives the readiest and in many ways the most accurate means of placing a school.

In both Board and Voluntary Schools it is found that there are many scholars who, although they have reached fourteen, the age of legal exemption from compulsory attendance at school, and having also passed through all the standards have thus completed the course of elementary education, are yet willing to stay and go on with their school work for another year, or perhaps two more years. A further year or two at school after having passed the seventh standard is of enormous value to the pupil, and the willingness of the parents to forgo his earnings during this period ought to be warmly encouraged. Obviously it is of little or no use to transfer such pupils to a Grammar School or Secondary School of the usual type, since the curriculum of such schools is arranged on the understanding that not only the pupil will stay on till seventeen or eighteen, but that he will commence, at the age of ten or eleven, subjects that are not taught to ordinary pupils in the Elementary Schools, and again is intended for pupils who will go on to the Universities and other places of advanced education. In order to take advantage of such a school a boy must have had his previous education arranged with a view to the wider course to follow. To introduce a boy or girl of fourteen into such a school for a year's finishing is a waste both of his time and that of the teacher. The methods of instruction are so different to those to which the pupil has

been accustomed in the Elementary School, that it is a long time before any profit can be gained by the instruction given. On the other hand, the Higher Grade Primary School, which takes the pupil who has successfully passed through the ordinary elementary course, and gives him instruction the same in kind but higher in degree, finishing off and completing what he already knows, is exactly suited to his needs. It is an excellent preparation for the Technical School and even the Science Colleges, but with no pretence of aiming at the University. It is when the Higher Grade Schools begin to trench upon the province of secondary education that objections begin to arise and fault to be found with the unnecessary expense involved to meet the needs of a very small number of scholars.

The Higher Elementary School * is, then, merely an institution, and as such a most valuable and indispensable one for continuing and completing the Elementary School course. As Lord Reay in his address to the School Board on their reassembling, 3rd October 1901, says:—

> "A Higher Elementary and a Higher Grade School are not Secondary Schools, neither are they Preparatory Schools; they are the final stage of elementary education. If a Higher Elementary or a Higher Grade School attempts to give secondary education it is on the wrong tack, and if a Secondary School invades the province of Higher Elementary or of Higher Grade Schools it is not accomplishing its objects."

There is little doubt that the new Act by placing both branches of education under the same authority has made this distinction less easy to maintain; the want of Secondary Schools of a lower grade is apt to lead to the conversion of the old Higher Elementary Schools into Secondary Schools, in which the pupils do not stay much after their sixteenth year. Schemes are being started in which an Elementary and Secondary School are carried on in the same building, the only difference being that certain class-rooms are furnished with single desks for smaller numbers and labelled Secondary School. Such a plan is not a satisfactory one, and there is much to be said for keeping the two classes of schools distinct. A Secondary School aims at something more than mere utilitarian teaching, and its higher objects should to some extent be expressed in its buildings. What may be called the amenities of the school require more attention, more

* In France there is a very complete system of Higher Primary Schools which are under the same management as the Elementary Schools, and are kept quite distinct from the secondary education. See Special Reports, vol. i.

provision for the social and corporate life of the school, rooms for private study, such as libraries; artistic surroundings, and so on—all seem to show that a higher form of culture is aimed at, due not necessarily to any social superiority, but to the fact that the pupils have the advantage of staying till a later stage at school, and so have time for a more complete education. This is of course not intended as an argument against bringing up the Elementary Schools to a higher standard, but as a protest against lowering that of the Secondary School—a tendency unfortunately observable at the present day in view of the difficulty of obtaining money.

Secondary Schools and their arrangements have in the following pages been treated at considerably greater length than have the buildings for elementary education. For although the former class of schools are more intricate in their organisation, and their planning is greatly complicated by the great diversity of methods and systems, they have, as mentioned in the Preface, received comparatively little attention at the hands of writers upon school architecture. This may possibly be due to some extent to the fact that such schools are in most cases private institutions, so that there is a lack of the tabulated information, particulars, and opportunities of inspection so easily available in the case of buildings erected by School Boards.

Buildings for Girls' Schools have been considered in detail and largely illustrated. Such schools in their present form are a comparatively new development, and so, being more open to innovation and experiment, serve well to show some of the newer methods of school planning.

In the arrangement of the matter the plan has been followed of giving first a general sketch of the existing systems and organisation in schools of different types and the conditions under which education is carried on; then to consider the extent of accommodation necessary, entering with some detail into the requirements of the component parts of the building, comparing as far as possible the methods adopted in this country with those of Germany and America, and finally to show the arrangement of the buildings as a whole.

Complete plans have as far as possible been given, on the ground that it is more interesting and instructive to see the plans of all the floors of a smaller number of buildings than that of one floor only of a larger number. Constructional details that are common to all types of building have been as far as possible avoided.

In selecting the schools of which plans have been given, great care has been taken to try and show the different types of building. Those

illustrated are for the most part recent, and embody the latest developments of school planning. It is not suggested that they show in all cases an ideal arrangement, or that they are merely models to be copied. They show how things have been done, not necessarily how they should be done. The aim of the book is to try and show to some extent the dependence of the plan upon the organisation of the school. As that changes so must the arrangement of the building. There cannot be, by the nature of the case, a model plan which will meet all requirements and suit all kinds of schools.

PART I.—SECONDARY EDUCATION.

CHAPTER I.

ADMINISTRATIVE AND GENERAL.

Secondary Education—Meaning and Scope of the Term—Difficulty of giving a Comprehensive Survey—Grammar Schools—Boarding Schools—Private Schools—Public Schools—Technical Education—Act of 1902—Board of Education—Constitution—Higher Education under the Act—The Local Authorities—Education Committees—Financial Resources—Secondary Schools—Different Grades—Organisation in relation to Plan—Various Types of Schools—Girls' Schools—High Schools—Meaning of the Name—Organisation of Girls' Schools—Boarding Schools—German School System—Description of Different Schools—American Schools and Educational System.

THE term Secondary Education is usually held to cover all the schools which come between the Elementary Schools and the Universities and great Technical Institutions—that is to say, between the schools whose course of instruction is arranged for those who do not intend to pursue their studies beyond the age of thirteen or fourteen, and the institutions receiving their scholars at ages from seventeen to twenty, who have finished their general education, and who wish for some form of specialised instruction in immediate preparation for the trade or profession they intend to follow.

The field covered is a very wide one, the term secondary including at one end the great Public Schools, such as Eton, Harrow, Winchester, &c., and at the other the little country Grammar Schools and small Private Adventure Schools, in some of which it may happen that the standard of education does not come up to that of a good Public Elementary School. These small, inefficient schools are rapidly disappearing.

It is not easy to give a brief and comprehensive survey of the conditions of secondary education in this country. There has grown

up a vast network of schools of an extraordinarily diverse character, but which vary from each other by such slight gradations in fees charged, subjects taught, and in the class of boys in attendance, that it is not possible to separate them, except in the roughest manner, into classes. There is, as a matter of fact, no uniform provision for the education of the middle classes in this country, and not only is the system of Secondary Schools incomplete in itself, but there is no regular connection with other forms of education above and below; overlapping at some parts, there are many others where there is no passage of communication. The want of a definite system of nomenclature undoubtedly adds to the confusion. It is rarely possible to give a name to any school which will at once convey a definite idea of its kind, or of its scope and curriculum. Some institutions are dignified by the name of College, though this is not generally intended to convey anything more than is meant by school, the terms being apparently interchangeable; the name College was most likely intended originally to convey some idea of superiority, probably in the social more than the educational sense. Even the name of "Public" conveys an almost exactly opposite meaning when applied to a Secondary School to that which it bears in reference to an Elementary School. The term secondary itself still conveys to some people a notion of inferiority, and is confused apparently with second grade. A Master of a Preparatory School, to whom the forms drawn up by the Royal Commission on Secondary Education had been sent, was quite indignant at the idea that any secondary education was given at his school.

There are large numbers of schools all over the country known as "Grammar Schools," many of which were founded as far back as the Tudor period or even earlier still.

A number of these schools were also founded and endowed by various wealthy persons, to whom it seemed a very admirable form of charity to provide the means whereby poor but clever boys could acquire a good education, and, when sufficiently able scholars, go on to the Universities and places of the highest education. It was for this purpose that in most of the older foundations there are carefully framed rules to ensure that at any rate a certain number of the places should be free, and that poor but deserving boys should be nominated for them by the Governors.

These Grammar Schools, started on much the same lines, had curiously diverse careers. Education at first was of a most simple character, the Classics, Latin and Greek, being considered not only the basis of education, but sufficient in themselves. At Eton, in the

early days, even Mathematics was an extra subject.* Gradually, however, the curriculum was extended as the difference between the classes for which the schools had to provide became wider; and as the expenses, owing to the larger teaching staff required, &c., began to increase, the schools became more dependent on the fees which they received. Some of the schools, unable to meet the increased demand, fell out by the way, or dwindled into the small second-rate establishments of which the Secondary Education Commission drew such a deplorable picture; others, generally those who either had a larger endowment or one which happened to be of a kind that increased very much in value, were equal to the needs of the time, and gradually became the recognised educational centres.

Parents wishing to take advantage of these institutions began to send their children from a distance, thus necessitating the provision of boarding-houses; the advantages arising from the boarding system itself added to the attractions of these schools, and so grew up the great non-local schools, of whose boys perhaps not more than 2 or 3 per cent. are, at the present day, drawn from the immediate locality. New and expensive accompaniments to education were being continually added, and a more or less distinct course became established as the ordinary education of a boy in the upper classes, leading as a rule to the University; but the expense involved, and the length of time during which the education went on, practically confined it to the upper and wealthier classes. Increased facilities of locomotion naturally helped the Boarding School, and, distance becoming of less importance, there was a natural tendency to the great predominance of schools that seemed to offer exceptional advantages.

Meanwhile the rapid growth of population and the discontinuance of the custom of founding and endowing Grammar Schools gave great impetus to the starting of Private Adventure Schools, a large number being what are known as "Preparatory" Schools, sending on their boys at the age of thirteen or fourteen to the various large Public Schools. These Preparatory Schools are a comparatively modern innovation, Mr Cotterill, in his Introduction to Vol. VI. of the Special Reports,† saying that he can find no traces of any true Preparatory School prior to the accession of Queen Victoria.

In recent years the pressing demand for good education for the middle classes at a reasonable cost has led to a great increase in the

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* Teaching and Organisation, edited by P. A. Barnett.

† Issued by the Board of Education, 1900.

size and efficiency of a number of the older schools that had sunk to a very low pitch. The Endowed Schools Acts of 1869-74 enabled the Charity Commissioners to take in hand the old foundations, to reconstitute and rearrange their financial bases, and to alter, where it seemed advisable, the terms of the bequest to suit the needs of the times. In this way, and by appointing new governing bodies, they were able to set in good working order a large number of schools that had dwindled to a state of complete uselessness. In the great provincial towns a large number of schools have been started under the auspices of the Local Authorities of the type known as High Schools or "Grammar" Schools, in a different sense rather to the name as used in reference to the old schools. These schools aim at giving a first-class education, not so much directed at all-round culture or preparation for the Universities, as at a curriculum adapted to prepare their pupils for certain definite purposes with immediate reference to the trade or profession for which the boy is intended. The distinction between "Public Schools" and "Grammar Schools" is not easy to maintain; there are so many which contain the qualities of both, that it is a difficult task to say in which category any particular school should be placed. Generally speaking, the Public Schools are the usual road to the Universities, and used by a class socially higher and more wealthy than that attending the Grammar Schools. This is shown, too, by their organisation; for while both are as a rule divided into Classical and Modern Sides, in the Public Schools, where the larger proportion of the boys is composed of pupils intending to proceed to the Universities, the Classical Side greatly preponderates over the Modern—a few even, as Eton, Winchester, and Charterhouse, having rather special classes than a regular Modern Side. In the Grammar Schools, however, the Classical Side consists of a few boys, most of whom are probably going in for scholarships: the main bulk of the school is on the Modern Side, with special departments arranged for teaching commercial and mercantile subjects, great attention being paid to foreign languages, correspondence, and shorthand.

The whole aspect of secondary education has been profoundly modified by the passage of the Education Act of 1902. This Act by appointing Local Authorities with power to consider all the educational needs of their areas, both Secondary and Elementary with the view to their proper relation and co-ordination, has provided at once the means and opportunity of introducing order and system into the somewhat chaotic order of things up till now existing in the field of Secondary Education.

The Board of Education * is made the central and ultimate authority charged with the general superintendence of all questions relating to Education, Elementary, Secondary, and Technical, in England and Wales.

The local organisation for dealing with the work is provided for in the second part of the Education Act 1902,† which is specially devoted to Higher or Non-Elementary Education. The Local Authorities constituted by the Act are required to consider the educational needs of the area, and take such steps as seem to it desirable, after consultation with the Board of Education, to supply, or aid the supply of education other than elementary, and to promote the general co-ordination of all forms of education. The Local Authorities are particularly warned to take into careful consideration any schools already existing in the area.

This Act constitutes the County Councils and County Borough Councils the sole Local Authorities for all education other than elementary.‡

The Municipal Boroughs and Urban District Councils may spend such sums as they like in aiding or supplying education other than elementary, but such sums must not exceed a penny rate. These bodies are not recognised as Local Authorities by the Government, except that Municipal Boroughs with a population of over 10,000, and an Urban District with a population of over 20,000, are appointed the Local Authorities for Elementary Education.

The actual carrying out of the administrative details of the work is done by the Education Committee, which every Local Authority is bound to appoint. This committee has power to deal with all educational matters, subject to the consent of the Council. They are able to depute any of their power and duties, except with regard to questions of money, to bodies of governors or managers, who carry on the school and are responsible to the Education Committee.

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* The Board of Education derives its power and constitution from the Board of Education Act of 1902, and consists of a President appointed by the Sovereign and certain members of the Cabinet, and is represented in the House of Commons by a Parliamentary Secretary. The administrative work is carried on under a permanent secretary, with a principal assistant secretary for each of the Secondary and Technological branches. The work formerly done by the old Science and Art Department, and that of the Charity Commissioners as far as educational endowments are concerned, are taken over and now carried on by the Board of Education, which is charged with the superintendence of matters relating to education in England and Wales.

† For full text of the Act see Appendix D, page 514 *et seq.*

‡ See page 294 for the Local Authorities for the purposes of Elementary Education.

The public financial resources available for secondary education are as follows :—

Endowments.—A sum of about £650,000 a year gross is available under the Endowed School Acts, with about £100,000 not subject to these Acts. In addition there are of course a number of endowments mounting up to a large sum, but which it is impossible to estimate.

Grants.—(1.) Given by the Board of Education. These are of various kinds according to the type of school, Pupil Teachers' Centres, and Training Colleges.

(2.) Grants given by the Board of Agriculture.

(3.) Parliamentary Grants for Evening Continuation Schools.

Funds.—The County and County Borough Councils may raise a rate for the purpose of education other than elementary ; this rate in the case of the County Councils must not exceed twopence in the pound without sanction from the Local Government Board. The Municipal Borough and Urban District Councils may also raise concurrently a penny rate. In addition to this a sum of money annually granted to the Councils of Counties and County Boroughs known as the "whisky money," forming the residue of the beer and spirit duties under the local taxation Act. This money, which was formerly limited to technical instruction, may now be applied to any educational purpose other than elementary.

The Secondary Schools in this country cover a very wide field from the great Public Schools at one end, to the rapidly disappearing class of small, ill-equipped Private Adventure Schools at the other, whose standard of education would hardly come up to that of a Public Elementary School. It is, however, hardly possible to divide them into types or classes, they differ from each other by such small gradations and differences, many of which are as much social as educational. The Royal Commission under Mr Bryce attempted to do so by means of the leaving age, classing as First Grade those schools that kept their pupils until eighteen or nineteen. These would be the most advanced form of Secondary School, leading naturally to the Universities. Second Grade Schools would be those whose pupils leave at the age of sixteen or seventeen ; while the schools that do not keep their pupils beyond the age of fourteen or fifteen would be put in the Third Grade.

The Royal Commission found that, while there was a fairly adequate supply of First Grade Schools for those who could afford to pay the high fees, there was a serious deficiency of good Second

and Third Grade Secondary Schools. This is the direction in which the energies of the Local Authorities are now turned. The great diversity in the arrangements and organisation makes any general statement as to school routine, &c., of little use, and the architect who has the planning of the building must, as pointed out above, make himself thoroughly acquainted with the needs of the particular school. A short statement, however, as to the general lines may be of use.

The points in the organisation that are of particular importance to the architect are—the number of classes or forms into which the school will be divided, and their probable size; the extent to which classes are subdivided, so that the extra class-rooms or division-rooms may be provided; the importance attached to science work and art teaching.

In the old days organisation cannot be said to have existed. The whole school learned the same limited number of subjects in one large schoolroom, so that the question of planning was settled when the size of the room to be built had been determined. Under the present conditions the building must at least provide a class-room for every class in the school. As a general rule there is a large hall or schoolroom in addition, not used for teaching, but in which the whole school can be gathered together when desirable, or for examination purposes. In this the school usually assembles for prayers in the morning; in many cases the class-rooms open directly out of it, so that all can get to their work with small delay and under easy supervision.

Many schools are divided into two sides, in one of which the education is classical and intended chiefly for boys who will ultimately go on to the Universities; the other teaching principally modern languages, and intended to prepare boys for the Army or certain professions.

Special classes for the Army and Navy or special examinations are often formed—all points that may well be borne in mind when the plans are in an early stage, so that suitable rooms or groups of rooms may be provided.

There are a certain number of schools that are arranged upon a method of their own, in order to give some special form of training—such, for example, as the school at Abbotsholme started by Mr C. Reddie, or that at Petersfield known as Bedales, under Mr J. H. Badley.* In these schools great importance is attached to questions

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* Plans and description of Bedales will be found on page 242 and Fig. 237.

of health, and to a training that includes a large proportion of manual instruction and a far wider range of subjects than is found in the ordinary schools.

Girls' Schools.—The last thirty years have seen a strong and widespread movement for the provision of schools for girls. The movement was stirred into activity by the heavy indictment of the Schools Enquiry Commission of 1867, not only against the lack of schools, but upon the utter inefficiency of all except a few of those existing. The want seemed principally for day schools in which thoroughly good teaching could be obtained at a reasonable fee. The way was led by the Girls' Public Day School Company, soon followed by the Church Schools Company, and various small local companies constituted to provide a school for their own district. Many also are due to the generosity of various persons or bodies, such as the great City Companies. In many cases the Charity Commissioners, in re-arranging old endowments, were able to provide funds for the establishment of Girls' Schools in addition to those for boys.

These schools are usually known as "High Schools"; large day schools with moderate fees and no distinction of class may be regarded as the typical girls' school of this country.

The name High School requires a word of explanation. To begin with, the word "High" is not intended to convey social superiority, but refers to the educational standard, though naturally, as the course goes on to eighteen or nineteen with fees that are high enough in many cases to make the schools self-supporting, the main bulk of their pupils are drawn from the middle and upper classes. The word does not correspond with the name as applied to the High Schools of the United States, where a pupil wishing to enter a High School must have previously passed through the Primary and Grammar Schools, so that the pupil entering a High School must be at least fourteen or fifteen years of age. The Girls' High Schools of this country take their pupils from the earliest age of going to school—many indeed have Kindergartens attached—up to the time of their leaving school.

Although there is far more uniformity of scheme and organisation in the case of Girls' Schools than in boys', yet there is no regular code or system that will apply to all schools alike, each school varying as a rule in detail to suit the needs of the neighbourhood in which it is placed. There are, however, certain broad lines which are common to nearly all High Schools.

The first point to be noticed is that it is an almost universal plan

that all regular class teaching should be given in the morning only, the hours as a rule being from 9 to 1.

The afternoon is reserved either for individual lessons, such as Music, Piano, and Solo Singing, Advanced Drawing and Painting, conversation classes in French and German, sometimes Greek and Advanced Chemistry. Preparation also is done in the afternoon. Girls who prefer to do so, or who have no facilities for working at home, stay or return to the school for the purpose. The object of this arrangement is to give the best working hours of the day to the important subjects, leaving for the afternoon special work, preparation, and accomplishments.

A large number of schools have a Kindergarten attached to them from which the children pass through a form, which is usually called the "transition form," into the school proper. The transition form is grouped for some purposes with the Kindergarten, sometimes with the first form; so that it is of considerable importance that their class-rooms should be close together, or arranged with sliding partitions, so that frequent changes can be made without too much waste of time and trouble.

The top form in the school is the sixth. It is not uncommon to have a special room for the pupils in this form known as the "sixth-form room," differing from an ordinary class-room by its furniture being fitted with a large table and chairs, and made to look more like a sitting-room.

The intervening forms, between the sixth at the top down to the lowest or first form, are arranged according to the size of the school and the number of forms required, being divided into upper and lower, or in two parallel divisions, as may be most desirable.

The school is sometimes arranged with parallel divisions all the way up, the girls who take Latin going to one side, those learning German to the other.

In a large school where the forms can be properly graded, it is usual that the whole form should move up at the end of the year together, as in the German Schools, any girl who is too far behind having to spend another year in the form. Of course in a small school there is too wide a difference in attainments to make this possible. Large numbers are almost essential to the proper and efficient working of a school. When the numbers fall below about 200, it becomes very difficult to grade the classes at all evenly, and either the backward are neglected or the clever ones kept back.*

* This would not, of course, be the case where the school is highly staffed, so that there can be a number of small forms of twelve to fifteen.

The reclassification for so many different subjects entails of course a considerable amount of moving about from one class-room to another. There are usually four or five lessons in a morning, and it may easily happen that a girl is in as many different rooms in the course of one morning. Provided that the building is convenient and well planned, this, so far from being a disadvantage, provides a useful and pleasant change. But it is essential that there should not be long narrow corridors, awkward staircases, and dark corners, for, unless the class-rooms are easily accessible, there is not only a great waste of time, but a considerable likelihood of disorder, as, where supervision is difficult, discipline is not unlikely to suffer.

The school opens usually at nine. The girls, after having taken off their outdoor boots—for it is an invariable rule that only indoor shoes shall be worn in the building—assemble in the hall for calling over and prayers, after which they go off to their class-rooms. The morning of four hours is usually divided into five sessions, with an interval of about twenty minutes in the middle, during which the pupils have a glass of milk and a bun, to make up for the necessarily early breakfast, followed by a few minutes' fresh air in the playground. The main work of the day is over by one o'clock, but a very large proportion of the girls either stay and have dinner at the school, or, if living near, go home and return in the afternoon for some of the special classes, or for games, which play a large part in the life of the schools.

There has arisen in recent years a considerable demand for a new sort of Boarding School for Girls, one which should be much more on the lines of a Boys' Public School, great attention being given to games and out-of-door pursuits, while giving an education of a high character, aiming perhaps chiefly at general culture, in which Classics should take an important place; and at the same time, by giving the girls in the upper part of the school a considerable share of responsibility in the management and discipline of the school, to train them in habits of independence and self-reliance.

The first school of this sort was founded in 1877 at St Andrews, and has been known as the St Leonard's School, since it acquired the buildings and grounds of the old St Leonard's College.

The school consists of the school-house and seven boarding-houses, each under the control of one of the senior assistant mistresses. The numbers are limited to 200, and the entrance age is from thirteen or fourteen to seventeen, no girl being admitted without first having passed an entrance examination graduated according to age.

Each house has a separate dining-room and study, where each of the elder girls has a small writing-table and bookshelf.

A playing field of 16 acres adjoins the school, providing a cricket field, golf course, lawn and gravel tennis courts, hockey ground, fives courts, &c. Great attention is given to games, and a healthy spirit of rivalry is kept up between the different houses by matches, each house having its own colours, and a keen interest is taken in these games.

The many advantages and attractions of this school, which began to draw girls from England in spite of the long journey, resulted in the foundation of The Education Company, by whose efforts another school has been established in the South of England at Wycombe Abbey, which has now accommodation for 200 girls.

The success of these schools shows that there is a real demand for "Public Schools" in the sense of the best class of Boarding Schools for girls.

Of a more advanced type is the school founded in 1885 at Brighton by the Misses Lawrence. The success of the school made it necessary to move into more convenient and larger premises. A site was secured between Brighton and Rottingdean, and the memorial stone of the new building, known as the Roedean School,* was laid by Mrs Sidgwick in 1897.

German and American Educational Systems.—In order to render more intelligible the plans of German and American Schools given further on, it will be as well to give a few notes upon the more salient points with regard to their system and general arrangements.

The principal aim of the German Secondary School system is to produce in their pupils a high standard of all-round culture, but to a certain extent with reference to the particular line in life which lies before them. Their schools are most carefully and clearly differentiated into certain well-defined types with distinct names, which clearly denote the scope and objects of the school. Each school is limited to one particular type, not combining two sorts of schools in one, as for instance is usually the case with our Secondary Schools with their Classical and Modern Sides.

By means of a highly elaborate but at the same time a smooth and easy working system of central and local administration, it is easy to compare the results of corresponding schools in different localities. This comparison, combined with the system of Inspectors, who are

* Illustrated, Figs. 185-192.

always men of high standing, usually, if not invariably, past Principals of schools, and so of experience in the work, makes it possible to test the value and efficiency of each school and so to ensure that all should be kept up to the same high level of excellence.

One point which has great influence upon secondary education in Germany lies in its close connection with the other parts of the national organisation. Successful completion of a six years' course in a recognised Secondary School gives not only exemption from one of the two years' compulsory military service, but at the same time a higher status during the one year. These leaving certificates have also a commercial value, as to hold one is a necessary qualification in obtaining a situation with any large firm. This naturally induces a very large number of boys to stay the full six years at school. Again, the professions—Law, Medicine, &c.—and the Universities require the successful completion of a certain course which is settled by the Government. It is by this power of conferring on or withholding from schools the right to grant these privileges to their pupils that the Government can force them to conform to their regulations.

In Prussia the administrative control of educational affairs is vested in the Minister for Religious, Educational, and Medicinal Affairs. He is a Cabinet Officer and responsible to the Crown only, but practically he is bound by public opinion and precedent to carry on the educational work along certain definite lines. He acts as a kind of ultimate Court of Appeal from the decisions of lower departmental officers; his department covers a wide field; it controls examinations and the privileges to be gained by them; has the final voice in the questions of choice of studies; regulates fees; fixes the salaries and pensions of teachers.

Properly speaking, there is no Minister of Education, education being but one of three departments as mentioned above. This particular department is presided over by an Under-Secretary with two chief assistants. These, with the assistance of an Advisory Council of nineteen, administer the whole school system. Internally the department is arranged in two main divisions—to one belonging the Common Schools (Elementary), Normal Schools, High Schools for Girls, and the schools or institutions for defective children; the other taking charge of higher education in the Secondary Schools and Universities. The immediate administration of the Secondary Schools is in the hands of the Provincial School Boards, of which there are thirteen, the President of the District being, when present, chairman *ex officio*. The place is, however, usually taken by the Governor of the District. The Board is as a rule composed of from three to five trained Inspectors, always selected from men

who have been Principals of Secondary Schools. These divide among themselves the different classes of schools, the senior member taking the highest class of the school.

The duties of these Provincial Boards include the supervision of all matters relating to the educational institutions that come under their jurisdiction. They are required to inspect and report upon the Higher Schools, on the appointment and dismissal of teachers other than Directors (Headmasters). Their reports must be sufficiently full and exhaustive to keep the Central Department of Education fully abreast of the state of affairs in every school. They do not examine or grant certificates to teachers, this being done by a Special Examinations Commission.*

The curriculum of any Higher School must go somewhat beyond the subjects which may be considered to be absolutely necessary, it being the essence of a High School that it should give, to some extent at least, a liberal education. The Higher Schools of Prussia may be divided as follows:—

Classical Schools - - -	*Latin and Greek.*
Gymnasien - - - -	Nine years' course.
Pro-gymnasien - - -	Six years' course.
Modern Schools - - - -	*But keeping Latin.*
Realgymnasien - - -	Nine years' course.
Real Pro-gymnasien - - -	Six years' course.
Modern Schools - - - -	*No Latin.*
Oberrealschulen - - -	Nine years' course.
Realschulen - - - -	Six years' course.
Höhere Bürgerschulen - -	Six years' course.

The Gymnasium is the highest class of school in Germany. It is the natural road to the Universities and the learned professions. Its aim is a high standard of all-round culture. It is divided into nine classes, one to correspond with each year of the course. Arranged in three divisions, the names of the classes, which it is convenient to know, as they convey at once a definite idea of the age and attainments, and are always found in the same numbers and arrangement in all schools, are —Ober Prima, Unter Prima, and Ober Secunda, in the first division; Unter Secunda, Ober Tertia, and Unter Tertia, the second; while the third division takes the classes Quarta, Quinta, Sexta.†

As a rule, a year is spent in each class, never less, but it may

* German Higher Schools, J. E. Russell, 1899.

† These names of the classes are often found marked on the plans of schools, as the size of the class is limited by its position.

happen that a boy is not sufficiently advanced to be moved up, in which case he has to remain a second year in the same form.

To obtain admission to a Gymnasium the pupil must be at least nine years old, and must have had three years' training in Reading, Writing, Arithmetic, and Religion. This may be had either in the Elementary Schools or Private Schools, or better in the special Preparatory Schools which are attached to many Gymnasien, known as Vorschule.

There is very little difference, as far as the Gymnasien are concerned, between the different States. In the Southern States there is a tendency to give a rather larger proportion of time to Classics.

The *Pro-gymnasien* are the same as the above, but having the lower and middle divisions only, so making a six years' course. They are found, as a rule, in the smaller towns, where there are not enough boys who would stay to complete a nine years' course. Such pupils are sent on to finish the last three years to some neighbouring town.

The aims of the *Realgymnasien* are the same as those of the Gymnasien :—To give the pupil a liberal education, but founded more on instruction in Modern Languages, Mathematics, and Natural Science ; so that, while the class divisions and arrangements are the same, the curriculum is a good deal altered, English taking the place of Greek, while a great deal more time relatively is devoted to French and Natural Science.

The *Realschulen* are Higher Schools in which the Classical Languages are not taught, with six classes in the normal course. In many cases, however, three extra classes are added, making the nine years' course complete. They are then known as *Oberrealschulen.* The object in view of these schools is to fit their pupils for effective and intelligent participation in the actual affairs of life. Particular stress is therefore placed on Modern Languages and Natural Science. The Prussian Ministry look with a very favourable eye on these schools, and try in every way to increase their number, even at the expense of the Realgymnasien, as it is to the pupils of these schools that the nation looks for its industrial leaders.

The *Höhere Bürgerschule* properly implies a High Grade Elementary School. The term, however, is rapidly falling into disuse, its place being taken by the Realschule.

Girls' Schools occupy in Germany a position very inferior both in position and in respect to State aid to that of the boys. As shown by Dr Wychgram,* there were, in 1897, 586 Higher Schools

* Handbuch des Höheren Mädchenschulwesens, Wychgram, Leipzig, 1897.

for Boys, nearly half of which are supported by State aid, while there are but 128 Schools for Girls, of which four only receive any Government assistance, all the rest being supported by private means, or worked for profit, or managed by the city in which they are located. The reason of their relatively small importance probably is due to the lack of openings which would offer a career to educated women. Till recently the teachers in the Girls' Schools were men, so that there were no posts to be gained by a thorough course of study; there were no privileges attached to the Girls' Higher Schools, so that there was no object in uniformity of curriculum or methods; they do not want women at the University, so that here again there was no object in going through the course of studies of the Gymnasium.

However, in the last few years things have improved very much. The permission to teach in the Higher Girls' Schools was gained, and, as candidates for teachers must pass a State examination, previous training of an adequate character became necessary. In 1894 a Ministerial Rescript was promulgated fixing the curriculum for the Higher Schools for Girls (*Höhere Mädchenschulen*), also providing for the appointment of women to any position in the upper grades.

Pupils enter at six years, there being no Vorschule as for boys.

There is in America the same widespread enthusiasm for educational subjects and the general public interest in it that is such a marked feature in Germany. The reasons for this are traced by Miss Burstall, in her book on American Girls' Schools,* partly to the democratic constitution of the country, which makes it so very necessary that those in whose hands so much power rests should be, as far as may be, fitted to make a good use of it; partly to the enormous foreign immigration, where the Public School, taking children of all classes, creeds, and nationalities, offers the best if not the only solution of the problem of how best to weld all this very mixed material into one homogeneous whole, to make a nation that shall to some extent have the same ideas and the same aims. Everywhere in books or papers on American education this feeling may be traced. English is enforced as the language in all schools, even in those where it is a foreign language to nearly all the children in the school, language being considered the great unifier. Private and Denominational Schools are not looked upon favourably, because they tend to strongly increase racial and class differences.

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* The Education of Girls in the United States, S. Burstall, 1894.

There is a singular degree of unity in American education, making it difficult to treat secondary and elementary education separately. Not only are they under the same authority, but they are very carefully arranged to lead from one to another—in fact, in America there is a complete ladder from the Elementary School to the University. Although the different States each manage their own educational affairs, there is not nearly so great a difference in their systems as one would expect to find: owing perhaps to the quickness with which new ideas are seized upon, and the completeness of intercommunications, due to the great number of teachers' societies and meetings, any scheme of education that seems successful in one State is very quickly adopted by others, anxious not to be behindhand in any improvements. "Not only is there a unity, there is an astonishing uniformity over the whole of the United States in organisation, methods, courses of study—everything. Some districts and schools are of course better than others; some are permeated by a different spirit. But in outward form the uniformity over so large an area, with such absolute local freedom of variation, is extraordinary. The Educational Exhibit at Chicago showed this uniformity in a remarkable degree; the educational literature, reports, school laws, &c., show it also. It is perhaps not too much to say that there is less difference in form between the schools of Boston, Chicago, San Francisco, and Seattle in the State of Washington, than there is between the different Girls' High Schools in London." *

The National Government in America has nothing to do with educational affairs, such matters being entirely under local control. Each State has its own school law derived from the State Constitution, which gives general direction. This is supplemented by Acts of State Legislation, in which are more detailed instructions, providing for the organisation of Local Boards, fixing the school age, particulars of compulsory education, &c. The School Boards manage the schools, levying the local rates, and erecting new buildings as required; arrange the curriculum, appoint teachers, and generally superintend the work of the schools. There is in addition a State Superintendent of Public Instruction, whose business it is to give advice, make reports, license teachers, &c. Schools are supported almost entirely by local taxation in the form of a property tax. There is, however, in addition a State fund, distributed by the authorities to equalise the burdens of taxation in providing for the poorer districts.

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* The Education of Girls in the United States, S. Burstall.

There is in America no system of inspections corresponding in the smallest degree to the organised inspection of Elementary Schools in this country, nor are there any great public examinations which can be taken by Secondary Schools, such as the Oxford and Cambridge Local Examinations, &c. The whole spirit of their education is, indeed, generally opposed to examinations, attempts having even been made to do away with the entrance examination to Universities, replacing them by a certificate to say that the pupil has been through such-and-such a course of study. This plan has not been adopted by such Colleges as Harvard and Yale.

The qualifications of teachers in the Public Schools are not governed by any general regulation. There is usually a preponderance of female teachers, due probably rather to the fact that they command a lower salary than to any theories on the subject.

The "Public," that is to say, the "Free" Schools—"Public" having that sense when applied to American Schools—are arranged in three grades by age. A Kindergarten is in some cases included in the first.

1. The Primary School—children of from six to nine years, learning Reading, Writing, Arithmetic, and the Elements of Language.

2. The Grammar School takes up the children as they leave the Primary School, keeping them if possible till the age of fourteen or fifteen, though of course many leave as soon as they are legally exempt in order to go to work. In the Grammar School, Grammar, Arithmetic, Geography, Literature, and United States History are taught. In the larger towns and cities there is a regular course of Manual Training included, and in some centres Natural Science. The higher classes of the Grammar School correspond to some extent to the English Higher Grade Elementary Schools or Third Grade Secondary Schools.

3. The High School takes its pupils at fourteen, fifteen, or sixteen years of age, to prepare them either for the University, or to finish their education by giving a broader knowledge and a more thorough training. This naturally tends to the establishment of two different sorts of schools. In Boston they are known as the English and the Latin, the latter being those which prepare pupils for the Universities. Attempts are being made to establish a third kind called Manual Training High Schools.

The point that at once catches the attention on looking at the organisation of schools in America is the fundamental difference between their idea of the connection between elementary and secondary

education and that prevalent in this country. The plan of classing schools according to the leaving age is thus quite impossible in America. All kinds of schools begin in the same way with the same subjects; the elements of knowledge are taught to all children alike, the only difference between lower and higher education being the point reached, the custom of beginning early certain subjects, such as Modern Languages and Latin, in the case of pupils who intend continuing their education till seventeen or eighteen, or are going to the Universities, being unusual in America, where the subjects are the same for all, whether they intend to go on or stop at fourteen. Of course this plan makes any scheme of progression from one school to another very much easier to arrange. Having completed the course at a Grammar School, a boy can either go on to a High School where he will find himself ready to go straight on with the work there, or he simply leaves school and goes to work, and is supposed to have been equally prepared for either course. The difficulty found in the English Secondary Schools of classifying and grading the pupils coming with a scholarship from an Elementary School is thus done away with—that is to say, the American idea is that all children, whatever their future, should begin with the same education, adding something each year, but always putting what may be called the necessary subjects first, so that Modern Languages and the Classics are put off until the High School is reached. This scheme makes the educational unity so complete, and the educational ladder so easy, that it is still carefully adhered to, although it is of doubtful advantage from a purely educational point of view; languages, to be acquired in any degree of perfection, should probably be commenced at an early age. This common use of the Public Schools by all grades of society presupposes for its successful working an absence of social lines or demarcation of class such as is perhaps only to be found in America.

The most important personage in connection with education in America is undoubtedly the Superintendent. "Within his own domain, whether a State, a county, or a city, he combines in himself the characters of a Minister of Public Instruction, an Inspector of Schools, a Licenser of Teachers, and a Professor of Pedagogy."* His influence extends to every detail of school life. Serious breaches of discipline, cases of expulsion, &c., come through his hands; he acts as adviser to teachers on methods of teaching; gives hints to young and inexperienced students; and is the technical expert by whose opinion the Local School Board is to a great extent guided on very many points.

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* Notes on American Schools and Training Colleges, p. 61, Sir J. Fitch.

Before admission to a High School it is necessary to have a certificate from a Grammar School or to pass an equivalent examination. This of course simplifies to a great extent the curriculum, as certain subjects having been sufficiently studied, they are able to devote their energies to higher work.

The organisation of a High School is simple. The pupils are arranged in years, admission being only allowed once a year in September, unless the applicant can produce satisfactory evidence of being able to take up the work at the proper point. At the end of the year they all go regularly on to the next year's work. Any who are too backward to do so either go over the year's work again, or perhaps more usually leave the school. At the end of the course of three or four years a diploma is given, but not as the result of any examination. There are, as a rule, in the High Schools several courses of study, one of which is chosen by the pupil on entering. There is the college course of four years ; the English course mentioned above ; then there is a commercial course of two years. In some cities there is a three years' course of engineering.

The word "class" does not convey the idea of a form in the English sense, but means all the students of one year, which may in a large school amount to 200 or more. These classes are divided up according to the different subjects taken by the pupils. In many cases, of course, these divisions are too large to be taken at once. They are then divided into sections, the teacher repeating the lesson. There is no system of grades or classification according to attainments, the whole "year" or "class" being kept parallel, although taught in sections. Thus there is never found at the top of the school a small form, such as the English "sixth," doing advanced work in different subjects.

The daily work in an American Public High School is confined to the morning, as a rule from 9 till 1.30. There is a "recess" or period of rest in the middle of the morning of about half an hour, when the pupils have a light lunch, either bringing it themselves or buying what they want at the school, a few who live close by returning to their homes.

There is a great variation as regards the custom of a general assembly in the morning before work. Any daily religious ceremony is unusual, but in some schools it takes place two or three times a week, or else the school is called together for some form of literary exercise. The morning is divided into five periods, one of which is given to private study—that is to say, while the lessons are going on,

the pupils who attend the subjects of them are in attendance, while the others, sitting at their own desks in special study-halls, go on doing work by themselves. It is necessary to bear this in mind when looking at the plans of American schools, as it explains the large school-rooms, the size of which is apt to strike any one who sees the drawings for the first time. The actual teaching is done, for the most part, in smaller rooms, which are called "recitation-rooms," and which correspond more to our class-rooms. At the close of each lesson period electric bells sound all over the building, and a few minutes, three to five, are allowed for the change of class-rooms. During this period conversation is allowed. Since the foregoing remarks apply as well to girls as to boys, there is no need to go into the subject of girls' education separately, as most of the schools are co-educational, educating the boys and girls together, and, even where there are separated schools, the subjects taught and the organisation of the school are so nearly identical as to make a separate account unnecessary.

There are in America, though to nothing like the extent in England, Private Secondary Schools, and under the term private are included schools governed by a Board, though not conducted for private profit—in fact, all schools that are not free. These schools are not numerous. They are conducted very much on the lines of the Public Schools, but are not subject to any inspections or regulations.

Chapter II.

SECONDARY DAY SCHOOL BUILDINGS.

Method of dealing with the Buildings in the following Chapter—Æsthetic Considerations in the Treatment of the Interior of Secondary School Buildings—**Sites** and the Questions which govern Position—**Aspect**—Advantage of plenty of Sun—Relative Merits of the different Points of the Compass—North and North-west, West and South-west, East and South-east, North-east—**Accommodation**, Extent required—Questions which determine the number of Class-rooms required—Necessity for Division Rooms—Sliding Partitions—List of the Accommodation required for a Large School for Boys—Similar List for a German School of the same kind—Differences—Girls' Day Schools: List of Rooms required—Consideration of which Rooms can be dispensed with, and how Retrenchment can be most conveniently made—List of the Minimum Accommodation.

In dealing with the subject of school buildings the following arrangement has been adopted:—First of all, to give some consideration to questions affecting school planning generally; and then, before proceeding to describe and illustrate examples of different schools in detail, to enter as carefully as possible into the questions of the extent of the accommodation required, the uses and purposes of the different rooms, and the form, dimensions, and position that have been found best adapted to serve those purposes. The object of this is to make the plans given later more intelligible, since the plan of the whole school can scarcely be understood, or at all events appreciated, without a clear idea of the purposes which the various parts of it are intended to serve.

There is, as a rule, in regard to the interior fitting and arrangement of Secondary Schools, too little attention paid to their æsthetic qualities. Schools are apt to have, to a quite unnecessary degree, the bare unattractive appearance usually associated with institutions. Although much can of course be done by means of pictures, engravings, &c., it is impossible in many cases to do much to relieve the monotony. The effect is often increased by having all the paint-work in the building a dull and dreary brown, while each class-room is an exact counterpart of every other. In recent years a great deal more attention has been paid to these questions,

a notable example being the new school for girls at Roedean,* which is not only spacious and healthy, but attractively and artistically treated. There is still, however, a good deal that might be done in this direction. It often looks as though much of this lack of the amenities of a building were due to the habit of freely adopting, in Secondary Schools, fittings, methods, and styles of building which have been found successful in the Elementary Schools, but which, though well enough adapted for them, are unnecessarily institutional and formal for a Secondary School. The modern Board School, with its clean and excellent, if somewhat bare, building, offers a quite sufficient contrast to the homes from which most of the children come, and is therefore perhaps quite as well adapted to give them a start on the road to a higher standard of living as would a building more elaborately treated. But to children, and especially to girls accustomed to the refinements of a cultivated home, the buildings of such a school are more likely to present a forlorn and forbidding appearance than to have any elevating tendency. Although it may and indeed does cost more to make a handsome interior, there should surely be set against this the fact that refined and artistic surroundings have a high educational value. So much is spent at the present time on teaching art directly, that some allowance might be made for influences of this kind, which are none the less strong because imbibed unconsciously. A careful scheme of colour decoration alone will do much to add to the appearance of a school without increasing the cost materially, while treating each class-room separately not only affords a welcome change to the eyes of the pupils when moving from one room to another, but gives a pleasant individuality to each room. There is the incidental advantage that it makes it easy to do up one or two rooms without doing up the whole building.

SITES

The best site for a school is naturally that of the best site for any kind of house—that is to say, the most healthy position would be the top of a hill facing south, with a gravel, sand, or chalk soil, sheltered to the north and east by trees, preferably pines; while the worst situations are those close to the bed of a river, or on low-lying clay soil. It should be remembered too that some situations, though apparently healthy, with a good soil such as sand or gravel, yet, owing to a subsoil of clay under the gravel, are nearly as unhealthy, owing to the impervious layer

* Described and illustrated below (see Fig. 190).

below, as though standing water showed actually on the surface. While books on school building generally give very careful and elaborate directions as to soil, site, aspect, &c., on which the building should be placed, it usually happens that the final position of the school is governed by very different considerations, especially in the case of Day Schools, which, to fulfil their purpose adequately, must be placed in easily accessible situations, close to large centres of population, and where the necessary space can be secured. In the case of non-local Boarding Schools, since they have not to study the convenience of day pupils, it is of course generally possible to pay due consideration to these sanitary questions. Naturally, too, they assume greater importance in the case of Boarding Schools.

The most important desiderata for the school building are good air, plenty of light, and freedom from the disturbance of noise, caused by traffic, factories, &c. To secure the first, the building should stand on high ground, and as far as possible from neighbouring houses. In this respect regard should be had to the likelihood of future building operations in the neighbourhood. Low-lying ground, or places ever liable to flood, are particularly to be avoided; for though by careful precautions the building itself may be kept dry, the playground will in wet weather have water frequently standing upon it, and be a cause of continual nuisance and a source of ill health.

Trees and shrubs, especially evergreens, planted so as to act as a protection against the cold winds, are an advantage, especially in the playground; but of course care must be taken that they do not in any way interfere with the lighting of the school.

In a town the school should be placed in as quiet and wide a street as possible. The noise from the street is very much less when the houses on the opposite side are low, while the light also is of course much better. It is worth remembering that if there is a narrow passage down the side of the school building, formed by a high house or a wall, the noise from the street will be caught and re-echoed very strongly into the class-rooms looking into any such passage. Any precautions taken, such as double windows, to exclude the noise to the front of the building, should also be taken for these windows, as it often happens that the noise thus arising from this confined area is actually more disturbing than that coming through the windows looking directly on to the main street. The school should of course be put back as far as possible from the street, to avoid the dust as well as the noise. When, as is sometimes the case, the school is brought up to the street level to make an imposing appearance or to draw attention, the class-rooms

looking out over the street should have double windows, though this precaution is of little use in hot weather, unless some complete scheme of mechanical ventilation has been installed. As far as possible the building should be planned so that the corridors and rooms where noise is of not quite so much consequence, as for instance studios and laboratories, music-rooms, dining-rooms, waiting-rooms, and staircases and corridors, should come on the street side. The strain upon the voice of a teacher in a class-room looking over a street is very great, and is likely to result in injury to the throat.

In the position of a school it is well that the approach to it should be carefully considered, *i.e.*, with regard to shops, mews, public-houses, or factories that the pupils will have to pass. This naturally is of great importance in the case of Girls' Schools. The neighbourhood of big factories is also to be specially avoided, owing to the dust and possible fumes.

With houses opposite there should be a sufficient distance to make sure that the light will not in any way be interfered with.* Rooms that are darkened and shut in by neighbouring buildings have a most depressing influence on those who have to occupy them, and are particularly to be avoided in school buildings.

If the school is on high ground, care should be taken that the approach should not be too steep, as in winter, during frosty weather, there are likely to be accidents, especially among the smaller children.

ASPECT.

The point towards which the school should face should of course be determined by the positions of the class-rooms, whether placed in the front or the back of the building, in order to obtain the most suitable aspect for their windows.

During school-time it is essential that every class-room should have an abundant supply of light, so that the class-room window should face towards the quarter whence is derived the best supply of light during the hours which they are in use. Further, it is essential, for the sake of the health of the scholars, that sunlight should have direct access to every room, at least during some part of the day, though it is sometimes argued, especially by German authorities, that it is advantageous if this can happen while the class-room is not actually in use; and

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* For this see on lighting of class-rooms, where the question of opposite houses is treated at length.

while this may be important in countries where the sun has during the summer much more power than in this country, it is seldom that much discomfort is felt here, except in the case of class-rooms facing due west, in the afternoon in summer.

The old Italian proverb, "Dove non va il sole, va il medico," is nowhere of greater truth than when applied to school-rooms, and the reasonableness of the old saying, that no room is healthy where the sun does not come, has been well proved by the recent researches and investigations made by bacteriologists on the effect of direct sun rays on bacteria and disease germs of all kinds, so that the disinfecting power of the sun is one of which the fullest use should be made in the arrangement of the school building.

The sun in the early morning and late afternoon, being then lower in the sky, will naturally shine much farther into the rooms than during the middle of the day. It is of course hardly possible to arrange that every class-room in a large building should have an equally good aspect; but, as far as can be managed, it should be arranged that none of the regular class-rooms should face the north only, except in the case of the studio, for which, as it requires a steady light, a northern aspect is best. The days when there is likely to be too much heat are in this country not very many, and a proper arrangement of blinds will make the management of the light easy. The hottest time of the year, too, falls usually in the summer holidays. The advantages of the sun are so great from the point of view of health, that they should outweigh a small amount of possible discomfort on a few days of the year.

The relative advantages of the different points of the compass may be shortly considered.

The North and North-west.—These aspects should never be used for class-rooms, as they get practically no sun until late in the day. If it is necessary that any rooms should have this aspect, these should be those which are occupied seldom, or for a short time only; and this side of the building may be taken up by the windows of the hall, studio, chemical laboratories, waiting-rooms, committee-rooms, staircases, or corridors.

West and South-west.—These aspects have an advantage in cases where it is preferred to have the direct sunlight into the class-rooms at a time when the rooms are not being used, since it is not till the afternoon that the sun will come into such rooms, and so in High Schools and others in which class-room work is as a rule confined to the morning the sun will only come into the rooms after the hours of

regular work. These rooms, however, in schools where work is done in the afternoon will get hot in summer, while missing the early sun in winter.

East and South-east.—Rooms looking to these points get the best light all the morning hours. The sun shines into the room in the morning, making the rooms cheerful and comfortable in the cold weather, while in summer the sun is off before the hot part of the day. The early sun, too, has not the same power in the morning as later in the day when everything has been heated. In the rooms looking due east the level rays of the early sun, except in midsummer, shine right into all the farthest corners of the room. For small children, Kindergartens especially, this aspect is very valuable. On the whole, perhaps the best aspect a school can have is that from east to south-east.

North-east and East.—For schools where teaching is carried on both morning and afternoon, Dr Baginsky,* writing of German Schools, recommends north-east to east. In such rooms the sun is off soon in the morning, and in the late hours will only shine a very short way into the room.

It is always as well, especially in arranging the exits and entrances of a school building, to take careful note of the prevailing wind in the locality, so that the door should be screened from it.

ACCOMMODATION.

The question of the extent of the class-room accommodation that ought to be provided for a school, the number of whose pupils have been already settled, is one to which as a rule too little attention is given. A Building Committee is apt to consider the question well disposed of when sufficient class-rooms have been provided to allow a seat for every scholar in the school, say ten class-rooms capable of holding 30 for a school of 300; and would be not unlikely to consider a Head Master or Mistress unreasonable, if with perhaps 250 pupils they began to complain of want of room and to ask for more class-rooms. This is a point upon which misunderstandings often arise between governing bodies and heads of schools. The number which the building will accommodate is given by the architect on the assumption of each class-room

* Schulhygiene, p. 51.

being filled, whilst the Headmaster with a considerably less number often finds himself much pressed for room. It may be worth while to consider briefly the cause of this difference, for the reason, though obvious enough, is very often overlooked. The class-rooms are as a rule built of one or two sizes, to take forms of say 30 or 40, with perhaps one or two capable of taking a larger number. It then happens that one or two small forms, such as the sixth, which even in a large school may perhaps not consist of more than 12 or 16 members, has to occupy a room capable of accommodating say 30. But it is in the middle of the school, where the largest forms are found, that the difficulties chiefly occur. It frequently becomes necessary to divide some form that is becoming of an unwieldy size, owing to promotion from the forms below being more rapid than usual, or slower into the upper forms, into two parallel divisions. This necessitates the use of an extra class-room, so that, while the total number of the school remains practically unchanged, an extra class has been added by the depletion of forms below, which, though not up to their full strength, still require their own separate class-rooms. Unless there are sufficient rooms to allow for this, there arises a tendency to grade the pupils by the size of the class-rooms instead of by their attainments. It may easily happen in a school of the size mentioned above, viz., ten class-rooms capable of holding 30, that there are ten forms, each requiring their class-rooms, varying from 16 or 18 to 25—better of course from an educational point of view; but it is not always easy to satisfy a School Management Committee that a building nominally capable of holding 300 can hardly be worked comfortably when there are not many more than 200 pupils in the school. Again, the system of splitting up a form into two or more divisions for certain subjects that require more individual teaching necessitates the provision of a certain number of division-rooms. These are in addition to the regular class-room accommodation, and should not be counted in reckoning the capacity of the school.

Difficulties of this kind are naturally far more marked in the case of a building that is not of recent erection, for it was formerly customary to provide rooms for much larger classes than would be considered right at the present day, the tendency now being very strongly in the direction of small classes. For instance, at St Paul's, West Kensington, built some eighteen years ago, the class-rooms are all capable of accommodating 40 boys. This school is, however, very highly staffed, and the average number in a class at the present

time does not reach 20. That is to say, since the rooms themselves cannot be divided, the actual accommodation of the school is at least halved. The question of the number of class-rooms to be allowed is usually approached simply from the point of view of the number of pupils to be provided for, instead of the number of classes it is intended to have. In Germany, where the number of classes in schools of similar kinds is always the same, the only question to be settled is that of how many it will be necessary to divide into parallel forms. There are no questions of such division or reclassification to consider; nor is there a small form at the top of the school, as our sixth form, standing on any different footing to the rest of the school, to be provided for. There is, however, almost invariably one spare class-room provided for each department of the school, to allow of any form which grows too large being divided into two parallel forms.

In this country, where the Secondary Schools present so many and such great differences in their organisation, it would be hardly possible to consider the question in this way, except perhaps in the case of the rebuilding of an existing school where the Headmaster can say what rooms will be required. It is hardly possible to overrate the advantage to the architect of having the Head Master or Mistress to give his or her advice as to what rooms will be required while the plan of the building is under consideration.

In the case of a new school too, when possible, the plan of appointing the Headmaster before the school is built will generally result in a building better adapted to the needs of the school.

In addition to the regular class-rooms for the form work, as mentioned above, the number of division-rooms usually required will be one or two, according to the size of the school, for each of the three ordinary departments, viz., upper, lower, and middle; but a few extra small rooms for the upper school will generally be found a great convenience to provide for small classes preparing for special examinations.

The plan of having two adjacent class-rooms separated by a sliding partition that enables them to be thrown together easily, though never found in German Schools, is often found to be of great use, so much so that it is usually recommended that there should be two so arranged on each floor, to meet the case of the temporary illness or absence of a master, or when it may be necessary to throw two forms together for the purposes of examinations, or for the purpose of a collective lesson or lecture.

In the case of a new and inexperienced master or mistress it is

sometimes expedient to put an older and stronger teacher next door, to give assistance if necessary.

Below is given a list of the accommodation that it is suggested should be provided in a large Secondary Day School for Boys organised on the usual plan of an upper, lower, and middle department. The sizes and use of the different rooms are discussed later.

1. Large assembly hall.
2. Class-rooms for every form in the school—or say, to allow of variation in size, four class-rooms to hold 30 for every 100 boys.
3. One reserve class-room in each department.
4. Two or more division-rooms to hold 15 to 20 in each department.
5. Sixth form room (where this is provided one class-room can be omitted).
6. Headmaster's class-room.
7. Chemical laboratory and store-room.
8. Physical laboratory and store-room.
9. Lecture-room.
10. Balance-room.
11. Dark room for optical experiments.
12. Room for Botany, Biology, and Microscope work.
13. Natural Science Master's room.
14. Museum.
15. Studio, small room for models, drawing-boards, &c.
16. Drawing-school for mechanical drawing.
17. Library for pupils.
18. Library for masters.

18A. Quiet room for cases of illness.

19. Assistant masters' common room, with separate lavatories and cloak-rooms.
20. Headmaster's room, with lavatory.
21. Secretary's office.
22. Clerk's offices, including stationery and book store.
23. Porter's office.
24. Waiting-room for visitors.
25. Committee or Board room, often combined with and serving for Secretary's room.
26. Dining-room, with kitchen, larder, scullery, serving-room, &c.
27. Cloak-rooms, lockers, &c.
28. Service-rooms on each floor for cleaning purposes.
29. Lavatory basins, say 7 per 100.
30. Closets, say 4 per 100.
31. Urinals, say 7 per 100.
32. Gymnasium and dressing-room.
33. Covered playground or playroom.
34. Playground.
35. Fives courts, tennis courts, and playing fields.
36. Storage-room for games, &c.
37. Heating chamber and coal storage.
38. Drying-room for wet clothes.
39. Bicycle shed.
40. Porter's or caretaker's living-rooms.

Such things as swimming baths, carpenters' shops, and various rooms for manual instruction and recreation, are added according to the objects in view and resources of the school.

It is not suggested that all these rooms are absolutely necessary,

but in a large modern school nearly all of them will be found. It may be of interest to compare with the above list the rooms that would be considered necessary in a German School of a corresponding type—that is to say, a Gymnasium and a "Real" Gymnasium combined. It is necessary to put the two together for comparison, in order to make it equal to the Classical and Modern Sides of our Secondary Schools. First as to the class-rooms required, it is here that the main difference is to be found. There are no division-rooms required. The classes are as a rule, especially in the middle forms, rather larger. By the Government regulations, the maximum size of classes in German Schools varies according to the department of the school—that is, in the upper department 30 is usually the maximum size, 40 in the middle, and 50 in the lower. As an example, in the St Maria Magdalene Gymnasium * at Breslau there are about 450 boys. Of the nine regular classes, seven, that is to say, all except the two highest, are split into two parallel divisions, making sixteen classes in all, varying in number from 20 to 25 in the top forms to over 40 in the middle of the school. A Gymnasium of the ordinary type, having a nine years' course, must have nine classes, whatever the size of the school, but may have more, as it becomes necessary, owing to an increase in numbers, to split any form up into parallel divisions. The following list is taken from the "Handbuch der Architektur," vol. iv. :—

1. A hall.
2. 9 class-rooms,† 3 for 30, 3 for 40, 3 for 50, with one reserve room in each department at least.
3. Room for the Natural History collection (Museum).
4. A class-room for Natural Science teaching and store-room.
5. Preparation room for Natural Science teacher.
6. Drawing-school.
7. Singing-school.
8. Headmaster's or Director's office and clerk's office.
9. Waiting-room for visitors.
10. Assistant teachers' room, with lavatory.
11. Consultation or conference room, sometimes serving the purpose of the assistant teachers' room.
12. Service-room, for cleaning, &c.
13. Cloak-rooms.
14. Lavatories.
15. Closets.
16. Urinals.
17. Gymnasium and store-room.
18. Playground.
19. Servants' living-rooms.
20. Sometimes Headmaster's living-rooms.
21. ‡Lecture-room for Chemistry, with preparation-room.
22. ‡Chemical laboratory and store-room.
23. ‡Room for mechanical drawing, store-room for models, boards, &c.

* Taken from the Annual Report.

† As many more as may be required by the numbers in the school necessitating division into parallel forms.

‡ Extra in a Realgymnasium.

There is not a great deal of difference in the rooms required in the schools of the two countries. No provision is made for dinner in the middle of the day in German Schools, and such rooms as carpenters' shops and manual training-rooms are found in the Technical Schools. They have as a rule a large room devoted to instruction in singing, which is not often found in an English School. German Schools of all grades invariably have a large and well-equipped gymnasium.

Girls' Schools.—As regards the extent of the accommodation that should be provided for a Girls' School, while it is on the whole much the same as that for boys, it has been thought that it would be convenient to give a complete list. It often happens, unfortunately, that the resources available for building schools for girls are, for various reasons, not as large as in the case of a Boys' School. For instance, in the rearrangement of an endowment or a charity, provision is often made for the establishment of a Girls' School; but as the Trust was not intended primarily for girls, their school is apt to come off second best as regards money. The result of this is that the question of accommodation turns rather on which of the rooms are to be considered indispensable than on those that might be considered desirable. For this purpose, in the following list, the rooms that are not absolutely indispensable are marked with an asterisk, and the considerations on which they can be omitted are treated afterwards. These remarks are of course to a large extent equally applicable to Boys' Schools. There are no very great differences observable between Girls' and Boys' Schools. There is perhaps in the former more attempt to make the rooms cheerful and homelike with pictures, flowers, china, &c. Girls' Schools have very commonly a Kindergarten or Preparatory Department attached, which of course involves a certain number of extra rooms. It is also possible to keep the school cleaner, and to have polished floors with all their advantages, owing to the custom in Girls' Schools of not wearing outdoor boots inside the building.

1. Assembly hall.
2. Class-rooms, 4 to every 100.
3. A reserve class-room or two.
4. Two division-rooms to every 100.
5. Chemical laboratory and *store-room.
6. Physical laboratory and *store-room.
7. Balance-room.
8. *Dark room for optical experiments.
9. *Room for Botany, Biology, and Microscope work.

* Asterisks are placed against the rooms that cannot be considered absolutely indispensable.

9A.*Room for Head Science Mistress.
10.*Sixth form room or class-room.
11. Studio, room for models and boards.
12. Cookery instruction room, if required by curriculum.
13.*Library for pupils' use as well as mistresses'.
14.*Lecture-room for Natural Science, with preparation-room.
15.*Museum.
16. Kindergarten-room, with separate cloak-rooms and lavatories.
17. Transition form room, next the Kindergarten.
18. Two rooms for teaching piano for every 100 girls.
19.*Room for teaching singing.
20. Assistant mistresses' room, with cloak-rooms and lavatory adjoining.
21. Headmistress's room and lavatory.
*Waiting-room for visitors.
Secretary's office.
22. Book and stationery store.
23. Cloak-rooms for school above the Kindergarten.
24. Lavatories, 7 per 100.
25. Closets, 5 per 100.
26. Dining-hall—kitchen, larder, scullery, &c.
27.*Gymnasium and dressing-room.
28.*Covered playground or playroom.
29. Playground — tennis and fives courts, if possible.
30. Bicycle shed.
31. Servants' accommodation.
32. Heating-room and coal store.
33.*Drying-room for wet clothes.
34. Storage-room for chairs, games, &c.
35.*Provision for examiners and inspectors.
36. A student-teachers' room, if required.
37.*Board or Committee room, with lavatory.
38.*A quiet room for cases of illness.
39.*A bath-room.
40. Service-rooms for cleaning purposes, with hot and cold water, on each floor.
41. Lift for coals, if open fires are used.
42. Some convenient arrangement for the mid-morning lunch.

This accommodation can of course be considerably curtailed without seriously impairing the efficiency of the school, and, as mentioned above, the question which most usually arises is rather what rooms it is impossible to do without rather than what rooms it would be an advantage to have. It is proposed to consider how far it is possible to reduce the list. And while on the subject of cutting down, a painful and distressing business, but one which from financial reasons plays usually so large a part in the preliminaries of a building scheme, it may perhaps be permissible to lay stress on the fact that cheapness and economy are by no means synonymous terms—an obvious truism

* Asterisks are placed against the rooms that cannot be considered absolutely indispensable.

enough, but one very apt to be ignored in the effort to reduce the cost of the scheme down to some particular figure. In no class of building perhaps does cheap or scamped work make itself sooner or more annoyingly felt than in a school, owing to the great wear and tear to which it is subjected. The last few hundred pounds is very often squeezed off at the cost of a considerably greater outlay afterwards on small repairs and additions.

It is now proposed to suggest how the rooms in the above list marked with an asterisk can be dispensed with. First of all, the accommodation given for Natural Science is on rather a large scale, and would be only found in a school which made rather a specialty of the subject—preparing candidates for Natural Science scholarships, &c. Where science is considered an important part of the work, and carried to a fairly advanced stage, it is essential to have two laboratories, in order that the delicate physical apparatus may not be injured by the fumes given off by the chemical experiments. In the case of small schools, however, and those in which the science work is of an elementary character, it is possible to get quite satisfactory results with a combined room adapted for elementary work either in Chemistry or Physics. Although it is a great advantage in a school of any size to have a room for the Science Mistress, as she is the head of a department of the school, it cannot of course be considered an absolute necessity. The library and lecture-room, useful and advantageous as they are, will probably be omitted when there is great pressure on space. The library is used by the elder pupils to work in at certain times by themselves, in order to learn how to use books of reference, &c., and is becoming more and more considered a necessary part of a properly equipped educational institution. It is hardly ever absent from a German School.

The lecture-room cannot be considered indispensable, but should if possible always find a place. It is often possible to combine the lecture-room and library in one, and also make the same room serve for the student-teachers' room, should there be any attached to the school.

The museum may well be considered a luxury which can be cut off without much loss. Cases can be stood in the corridors or anywhere where there is room to accommodate any collections that the school may happen to possess.

It is sometimes suggested that a studio can be dispensed with, on the ground that two large class-rooms capable of being thrown into one will serve for the purpose. In the conditions of a recent competition

for a Girls' School, a double class-room was allowed in the accommodation as an alternative to a studio. It is only as a last resort, I think, that this should be permitted. To begin with, the use of class-rooms which presumably have their proper forms must lead to considerable disorganisation in the school arrangements. It does not at all follow that a well-lit class-room will make a well-lit studio in fact, just the reverse of this is more likely to be correct. The difficulty, too, of disposing of all the stands, easels, models, and drawing-boards, with the consequent loss of time, make a compromise of this sort very undesirable. As long as drawing was more or less an extra subject, taken perhaps in the afternoon, these objections were less felt. Now that it is a regular class subject, a studio may fairly be considered necessary. In the case of a small school it is possible, although inconvenient, to use the central hall for the purpose of drawing.

Another plan of making one room serve two purposes, for the sake of saving space, is managed by so placing the Kindergarten-room that it can also be made to answer the purpose of a dining-room. As the Kindergarten goes on in the morning only, and is over by half-past twelve, it is possible to manage to have the room ready for lunch by one o'clock. The room must of course be near the kitchen, and have the tables arranged with trestles, so that they may be easily removable, some handy place of storage for them being provided. The arrangement, though by no means an ideal one, is a considerable saving of space, and if well arranged can just be made to work. It should be remembered that if there are students in training in the Kindergarten, the room will be again wanted in the afternoon ; in this case such an arrangement is very undesirable.

The need of a gymnasium can be met by placing the gymnastic apparatus in the assembly hall. It is necessary in this case to guard against the production of too much dust, but, provided that there is a polished floor, and that no exercises requiring the use of mats or mattresses are indulged in, little objection will be found. Complaints, however, are sometimes made on æsthetic grounds, perhaps not unjustifiably, that it spoils the appearance of the hall.

The class-room accommodation is the last thing that should be touched. The inconveniences arising from the lack of room here are serious, very prejudicial to the work of the school, and even to health. Small subdivisions have to be taken in any corner where they can find a resting-place, at one end of the hall, or the end of a corridor. I have even seen cases of a division eventually finding a haven of refuge in one of the cloak-rooms. Under these circum-

stances the class-rooms are never vacant ; there is no time during which they can be ventilated ; classes and divisions have to be continually driven about, with no regular place for work, and the strain becomes too much for the most long-suffering Headmistress and staff.

The advantage to the school, the gain in ease of organisation, saving of time and friction, and in the increase in efficiency produced by having a room definitely allocated to each school purpose, can hardly be overrated.

The following list of accommodation is given as what may be considered an irreducible minimum :—

Assembly hall, fitted with gymnastic apparatus.
One class-room for every 25 girls.
One division-room for every 100 girls.
Combined room for science teaching.
Studio.
One music-room for every 100 girls.
Assistant mistresses' room and lavatory.
Headmistress's room and lavatory.
Secretary's room, serving also for waiting-room and book store.
Cloak-rooms, lavatories, &c.
Kindergarten-room, serving also for dining-room, and placed close to necessary kitchens, sculleries, &c.
Heating - room, coal cellars, &c.
Service-rooms.
Lift.
Bicycle shed.

It is no doubt possible to work a school with even less accommodation, but the above list may be taken as giving the rooms which any school pretending to carry on its work efficiently ought to have. The standard of requirements for school buildings has risen so much during the last few years, while unfortunately the cost of building has gone up no less quickly, that governing bodies find it difficult to keep their schools abreast of the times. In addition to the increase of accommodation required in the building there is also a similar tendency to increased expense in educational matters—very much larger staffs of teachers are required and with larger salaries ; while at the same time the fees charged to the pupils have remained the same, or have been increased to a very small extent. Schools with a valuable endowment, and those belonging to rich City Companies, or those, such as the Higher Grade Schools, which can fall back on some reserve of public money, are able to meet the additional expenses, and set a standard to which it is difficult for those dependent on the fees they receive to attain.

Chapter III.

SECONDARY DAY SCHOOL BUILDINGS

(Continued).

Details of the various Rooms, &c.—**The Hall**—Size, Lighting, Position, Exits, and Entrances—Expedients for gaining Space in Hall—**Staircases**—Their Position, Form, and General Arrangement—Emergency Stairs—Box and Open Staircases—Width required Height of Risers in Germany and America—Material for Treads—Handrails—**Corridors**—Width required—Uses of a Wide Corridor—Lockers placed in—Material for Flooring—**Entrances** to the School Building—Pupils' Entrances—Porch for waiting in—Supervision—Tradesmen's Entrances.

THE HALL, OR ASSEMBLY ROOM.

The hall should be amply large enough to seat all the pupils in the school, with a margin in case of increase in the numbers. As a rule there is required considerably more room than is actually taken up by the school, as in the case of prize-givings and entertainments it is usual to ask parents and friends. It is, however, open to question as to how far it is a good plan to make any allowance for functions which occur only a few times in the year, when there is probably a Town Hall or some convenient place that can be hired for the purpose. This has the additional advantage of connecting the school with the neighbourhood, and of increasing the local interest in it. In cases where there is any want of money, it is probably better to limit the size of the hall to the actual requirements of the school, in order that the saving should not be at the expense of the class-rooms.

It is not very easy to find any data on which to base a calculation of the amount of floor space that should be allowed per pupil in the hall; there is so large a variation in different schools, the measurements of the hall depending to a large extent on the resources available, and the type of building adopted, and the purposes for which it will be used. For example, in the school for boys recently erected in Holborn by the Mercers' Company there is a handsome and well-decorated hall, measuring 70 by 40 ft., with an arcade

on one side leading to the class-rooms. The school is intended to accommodate 300 pupils, so that this gives an allowance of 9 sq. ft. per head. In the King Edward VI. School for Girls in Birmingham, another recently built school on a very liberal scale, the hall measures 68 by 31 ft., which, the number the school is intended for being 350, gives about 6 sq. ft. per head.

The new buildings for the Grammar School at Bedford, having a class-room accommodation for over 1,000 boys, provide a hall measuring 102 by 50 ft., which, including the platform, gives an allowance of 5 sq. ft. ; but as there are in addition two large galleries, there is sitting-room for a large number. The Rules of the Board of Education* require an allowance of 8 sq. ft. per head. This will be found a very satisfactory basis for calculation unless the numbers in the school are large ; as soon as the numbers rise to 300 a smaller allowance per head will be found sufficient, falling say to 6 sq. ft. when the school rises to upwards of 500. The possibility of future additions to the school should be carefully considered in settling the size of the hall, for, while it is generally easy to add on class-rooms, any addition to the hall is likely to be a matter of considerable difficulty and expense.

Various devices have been tried from time to time for the purpose of increasing the size of the hall, when required for special occasions, by making the class-rooms next the hall with partitions that are easily removable. For an example see Fig. 166, in which it is possible to throw practically all the class-room space into the hall. Two class-rooms are sometimes placed at the end of the hall opposite the platform, separated from it by rolling or movable shutters. The latter leave a pier in the middle when the rooms are thrown into the hall. Additional seating accommodation can often be gained by placing a large room, such as a studio on the first floor, so arranged that it can be used as a gallery to the hall. See Fig. 73, where this has been done. Expedients of this nature are, however, in Secondary Schools of doubtful advantage. The disturbance caused by noise, against which partitions are rarely proof, if capable of being moved, is hardly compensated for by the very occasional use made of such an arrangement.

In schools that are sufficiently provided with rooms to obviate the necessity of using the hall for drill or gymnastics, or for any purpose beyond that of assembling the whole school, it is usual to find it fitted with benches or chairs. But in schools that are not so well off, the

* For these rules see Appendix B.

floor has to be left clear, and provision must be made for the storage of the chairs which would then only be used occasionally, the pupils standing for daily prayers, &c. The space under the platform is commonly utilised for this purpose, but this, unless of unusual size, is not sufficient, and further room must be provided.

It is of course as well to ascertain whether the hall is to serve as a gymnasium, so that the necessary constructional arrangements may be made for suspending the various kinds of apparatus.

When the plan of the building will allow, there is little doubt that side lighting is preferable, as it makes the questions of heating and ventilation easier. Great care has to be used in estimating the amount of glass required when halls are lit from the top, and considerable judgment to prevent shadows being cast by balconies or galleries. "Centre top lights are rarely successful for school-rooms of any kind. . . . In fact, one has to be very careful indeed to avoid having too much lighting surface, which, it must never be forgotten, is also chilling surface in cold weather and heating surface in summer-time." *

The question of the position of the hall in reference to the class-rooms is discussed more fully in the chapter on planning, but, whatever the type of plan that may be adopted, there are certain points in regard to the position and arrangement of exits and entrances to the hall that should be carefully borne in mind. It should of course be within easy reach from the class-rooms; it should also be easily accessible from the front entrance of the school, as, in case of entertainments, lectures, or prize-givings which take place in the school hall, it is a great convenience that there should be a simple and direct way from the front entrance to the hall, and one which is separate from that used by the school, in order to avoid the crowding that would be caused by visitors and pupils all leaving by the same exit. It is further necessary that there should be an entrance close to the platform, so that the Governors of the school or prominent persons who are to distribute prizes or occupy seats on the platform should not have to squeeze their way right up the hall, which on such occasions is usually filled to its utmost capacity. An entrance at the back of platform from a small ante-room or class-room is found a great convenience: when, as often happens, some form of dramatic entertainment is taking place, it can serve as a green-room (see Fig. 117).

Sometimes it is found convenient to have at the end of the hall

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* The Planning of Secondary Schools. Paper read to the Architectural Association, London, 11th December 1897, by J. Osborne Smith.

opposite the platform three or four rows of seats raised from the floor. This makes it easier to see the platform, and, although it detracts from the free floor space, it serves very well for singing-classes, for which in Germany it is usual to find a special singing-hall, not usually provided in English Schools.

There should, under all circumstances, if the school contains above 150 pupils, be at least two main exits from the hall leading directly to different staircases, so that the room can be at once cleared without danger of crushing in case of panic.

The part which the hall plays in the whole course of the management of a school is so important, especially, as remarked above, in those schools not sufficiently equipped to have special rooms for every purpose, that it is impossible to exercise too much care in its planning and arrangement.

STAIRCASES.

In schools where there are both girls and boys, it is necessary to supply a separate staircase for each sex. Staircases should be thoroughly and efficiently lighted in every corner, and should have at least one external wall; winders or elliptical staircases should under no circumstances be allowed. Long flights without a landing are dangerous, and apt to lead to numerous accidents, while flights that are too short, say less than eight steps, offer a strong temptation to jump the whole distance; about ten steps to a flight will meet both these objections; in any case the number should not exceed fourteen. In any school where the numbers reach 150, two staircases should be provided, placed, as far as possible, at either end of the building. Too great care cannot be exercised in the position and arrangement of the staircases. They should not finish close to the door of a class-room, for not only will the noise cause great inconvenience, but if the class in that room happens to be dismissed at the same moment that a number of pupils are coming down, there will be a likelihood of considerable disorder. A staircase discharging into the middle of a corridor at right angles will be apt to have the same effect, unless the corridor be of considerable width, or have an enlargement for the purpose.

The staircases leading to the cloak-rooms, especially in the case of schools with one large cloak-room, need considerable care in arrangement, since there are often very large numbers entering and leaving at the same time.

There is an excellent plan in the High School for Girls at Birmingham (Fig. 123), where there is one staircase used only for descent, and

at the other end one for ascent only. This not only saves a great deal of confusion, but has the further advantage that when entering the school the girls coming down by the one staircase leave their outdoor boots in the cloak-room, and, entering the school by the other staircase in their house shoes, bring no outside dirt or dust into the building.

The landings on stairs should be square and of as large a size as may be possible, so that in case of two streams meeting there may be a backwater in which one lot may wait.

The stairs are sometimes doubled as far as the first floor (see Figs. 70 and 71). At the Bedford Grammar School the staircases discharge opposite a large bay window which allows considerable extra space.

The test of a well-planned staircase is the absence of any staircase rules in the school regulations.

The staircases should not be in the middle of the building, as the danger in case of fire is much increased, and should always be continued right up the building, *i.e.*, it is a dangerous plan to have two staircases up to, say, the first floor and one only to the second or third. In the case of panic, disaster would be inevitable. In America it is not uncommon to provide a special staircase outside the building, to be used only in case of emergency (see Fig. 321).

There is considerable difference of opinion as to the relative advantages of box staircases, *i.e.*, those with walls carried up each side, or open stairs with balustrade. In "Modern American Schools" Mr W. Briggs speaks very strongly against open stairs, on the grounds of the great danger in case of the sudden pressure, if in case of fire or panic one child should fall, that would be suddenly brought to bear on the banisters and rail, giving a terrible story of an accident of this nature that happened some years ago in New York. But it should surely be possible to make the banisters and rail of sufficient strength. Closed-in staircases are recommended in the Building Rules issued by the Board of Education, but strong objections are very often made to them in Secondary Schools, partly on the ground of their rather unsightly appearance, and also on the ground of the impossibility of effectual supervision. It is a considerable advantage to be able to see right up the stairs from the bottom.

Width.—The width of stairs may be considered from two points of view—first, that of the safety of the children while going up and down; and secondly, their power of quickly emptying the rooms above. For the first reason, it used to be recommended, in order that every child should have one wall and a handrail to prevent

it from falling, that whatever the number of children in the school the width of the stairs should not exceed 4 ft. "When the width is enough to allow of several children to go abreast, there is risk of those in the middle being pushed downstairs, and hence it would appear that 3 ft. 6 in. to 4 ft. as a maximum may be regarded as an extreme width sufficient for the largest schools." * This was for a long time the size adopted by the London School Board, but of recent years the tendency has been to make them wider, Mr Bailey,† architect to the London School Board, recommending from 3 ft. 9 in. to 5 ft. Provided that the steps are not of too steep a pitch, and the flights short with large landings, it would seem there is little danger in having them of considerable width. It is particularly important in Secondary Schools when classes often have to change their class-rooms, and so constantly going up and down, that two double rows should be able to pass one another. For this purpose 4 ft. should be regarded as a minimum.

In the German Schools the stairs are generally formed of considerable width. In Prussia the minimum width of stairs is fixed at 4 ft. 3 in. By the regulation issued in 1892 they are required to give :—

1. 2 ft. 3 in. for every 100 persons up to 500.
2. A further 1 ft. 7 in. for every 100 more up to 1,000.
3. A further 12 in. for every 100 persons above 1,000.

This would in the case of a school of 1,000 scholars mean a staircase breadth of nearly 20 ft. In this case, of course, the requisite breadth would be provided by having two or three staircases. The different States have different amounts laid down for the minimum breadth, but the average width of the stairs as built is just under 5 ft., and for large schools about 6 ft. 6 in.

Height of Risers.—The height of the risers has been fixed by the Board of Education as not more than 5½ to 6 in., with a tread of 13 in. for Elementary Schools, while for Secondary Schools the height is limited to 6 in., with a tread of not less than 11. On the whole, where there is sufficient space, a 6 in. rise, with a 12 in. tread, will be found to give a comfortable proportion. Care should be taken to see that the nosings do not project far over the treads, or there is a tendency to trip and fall going upstairs.

Much the same dimensions are found in German Schools. Werth recommends that the risers should be 16 cm. (about 6¼ in.), and

* School Architecture, Robson.

† The Planning of Board Schools. Paper read to the R.I.B.A., 1899.

gives the formula that twice the height in centimetres plus the tread should come to 63. In Prussia the height of risers is limited to $6\frac{3}{4}$ in. While differing slightly in different States, the average all over Germany comes to about 16 by 31 cm., that is to say, $6\frac{1}{4}$ in. risers and 12 in. treads.*

In America † the proportion again is the same, the width of tread being usually 12 in., while $6\frac{1}{2}$ in. is considered as a maximum height in High Schools, but which may be reduced to 6 in. for Primary Schools.

Material for Stairs.—While stone staircases are doubtless best for the Public Elementary Schools, they are not as a rule liked in Secondary Schools, and are strongly objected to in the case of Girls' Schools. Whatever material is adopted, the construction must be thoroughly fireproof. Stone has the disadvantage of wearing slippery, nor is it to be depended on in case of fire, the steps being apt to crack off when subjected to heat. As a matter of fact, a solid staircase of some hard wood is the safest of all in case of fire. In the Boarding House ‡ for St Paul's Preparatory School, West Kensington, the staircases were all constructed of oak, after consultation with the Fire Brigade Authorities, as being the best fire-resisting material. The expense of this is of course considerable. A staircase formed of concrete with thick teak or oak treads will obviate most of the unpleasantness of an all-stone stair, with the additional advantage of making replacement of the treads easy when they become sufficiently worn to be dangerous. Iron staircases with treads of slate or steel and lead are often found in American Schools, and are there recommended.

But whatever material is finally determined upon, care should be taken to see that it is one that does not become slippery by use.

Handrails.—Handrails must of course be provided. In cases where there is very considerable variation of size in the children using the staircase, two handrails are sometimes provided. The custom of placing the small children on the ground floor in this country usually makes this unnecessary. The rails themselves should be about $2\frac{1}{2}$ in. diameter and of wood. Iron piping is sometimes used, but, though serviceable, is disliked owing to its coldness.

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* Schulhygiene, A. Baginsky, and Handbuch der Architektur, vol. iv.

† School Hygiene, Shaw; School Architecture, Wheelwright.

‡ See Fig. 234.

CORRIDORS.

Corridors in schools which are not planned on the system in which the class-rooms open directly out of the hall become an important feature in the building. As great a width as can be managed should be allowed, the appearance and importance of the building being thereby increased. But in no case should a minimum width of less than 7 ft. be allowed, 9 or 10 ft. being better. It is a matter of great importance that the corridor should be thoroughly lighted in every part, as it serves for a number of purposes besides merely that of affording access to the class-rooms. In many schools it is customary to place the boys' lockers in the corridor, the advantage being that as they are spread over a large area it is easy for a number of boys to get at their lockers at once. It also ensures their being in easily accessible positions, as for example in the Mercers' Company School in Holborn, recently erected (Fig. 123), as also in St Paul's School, West Kensington (see Fig. 119).

The material used for the floor of the corridor is of considerable importance. Not only must it be something that will not become slippery, but it must further be something that will not throw up dust. Concrete is particularly bad in this respect. Asphalte, which is sometimes found, is not satisfactory, being unsightly, dusty, and apt to wear into holes. Stone has the disadvantage of being excessively noisy in addition to most of the above drawbacks. On the whole, perhaps well-laid wood blocks will be found as satisfactory as anything, more especially if wax polished. In the basement corridors leading to cloak-rooms, lavatories, &c., red paving tiles can be used with advantage.

In the buildings where the corridors are of a fair size, say not less than 10 ft. wide, well lit and warmed, there is a great opportunity of adding to the attractive appearance of the school. It can be used as a sort of picture gallery for any prints, engravings, or pictures that the school may possess. Notice boards with school notices are frequently found there. In schools where special attention is paid to drawing and painting it is very common to find a selection of the best work done during the week pinned upon large boards hung in the corridors, providing not only an incentive to work, but a pleasant change of decoration. There are a great number of purposes to which a wide and spacious corridor can be put. Small divisions, when the school is rather full, can sometimes find here a quiet resting-place.

ENTRANCES.

The entrances to the school building for the pupils should of course be quite distinct from the main entrance to the building. They should be so arranged as to lead directly to the cloak-room, so that wet and muddy boots and clothes should not be taken farther into the building than is necessary. The entrance should be, as mentioned above, arranged with a special view to the cold and prevailing winds. This of course may be impossible in a town. There should be a large porch or covered entrance, as it often happens that pupils, for various reasons, arrive at the school some time before the building is opened, and, unless there is some place in which to wait, they will have on rainy mornings to stand about in the wet till the school is open. If an inner entrance hall can be provided, it makes a great difference to the comfort of the building in cold and windy weather. It also offers an excellent place to arrange umbrella racks where umbrellas can be left to drain, and not be brought farther into the building. The pupils' entrances should be so arranged that they can be clearly seen from some point inside the building. It often happens that it can most conveniently be overlooked by the Head Master's or Mistress's room, since the commonest place for that room is close to the main entrance, and the entrances are likely to be on the same side of the building. In larger schools, and generally in Boys' Schools, this business would naturally fall to the lot of the porter.

The tradesmen's entrance should of course be kept as distinct from the school part of the building as the site will allow.

Chapter IV.

SECONDARY DAY SCHOOL BUILDINGS

(*Continued*).

THE CLASS-ROOM.

Importance of proper Lighting—**Size of Classes** to be provided for—Average in English Schools—Ditto in Germany—The Factors which govern the Size and Shape of Class-rooms—Best Shape of Room—Methods of grouping Desks—Size and Shape of Desks—Great Variation in Size of Boys of same Age—Advantages and Disadvantages of Adjustable Desks—Position of Desks relative to Walls, Windows, and Doors—**Dimensions of Class-rooms** should suit type of Desk to be used—Class-rooms of English, German, and American Schools compared—Height of Class-rooms—Question of raising Back Rows—Position of the Fireplace—Ditto of Door—Teacher's Platform—Blackboard—Picture Rails, &c.—Sliding Partitions—Class-rooms in Elementary Schools—Maximum Number to be accommodated—Superficial Area to be allowed—Different Desks and their Dimensions—**Lighting—Day Light**—Difficulty of judging the Illumination Allowance to be made for Dark Days—Difference caused by Aspect, Surroundings, &c.—Height of opposite Houses—Use of Ribbed or Prismatic Glass—Proportion of Glass Surface to Floor Area—Position of Windows—Thickness of Piers, &c.—Top Lighting—Height of Window—Height of Window Sill—Model Class-room according to Erismann—Summary of Results—Form and Construction of Windows—Blinds—Colouring of Walls and its Effect on Light—Ceiling—**Artificial Lighting** — Requirements — Petroleum Lamps—Regenerative Petroleum Lamps—Gas—Gas Jets—Welsbach Incandescent Burner—Difficulty of—Siemens Regenerative Lamp—Suggested Position in Class-rooms—Acetylene Gas—Electric Light—Need of sufficient Lamps—The Number required—Their Position—Use of Holophane Globes—Lighting Rooms by reflecting Light from an Arc Lamp.

On the suitability and proper arrangements of the class-room in regard to light, ventilation, and warming, the comfort and health of a school depend to a very large extent. The class-rooms may be regarded as the units of which a school building is composed, to which the other rooms are subsidiary; and since the teachers and scholars spend the greater part of their time while at school in these rooms, the importance

of having them properly lit and ventilated can scarcely be overrated. Medical opinion is practically unanimous on the point that short sight, now so prevalent, is caused, or at all events greatly aggravated, by working in badly-lit rooms during the period of growth; and since eyesight is so intimately connected with constitutional condition, bad air, caused by lack of ventilation, probably plays nearly as important a part as the want of proper light. As Dr Clement Dukes remarks in this connection—"It is a fact that boys working under unfavourable conditions, and with insufficient light during school life, are sustaining serious injury by the production of short sight." * Light, even if fairly strong, may, if admitted from the wrong direction, cause, besides injury to the eyes, many other long-lasting evils, such as curvature of the spine, crooked shoulders, &c., owing to the awkward positions adopted by the scholars to avoid sitting in their own light, or to get the best of what light there is.

The production of a really satisfactory class-room depends upon careful attention to a number of small details; the exigencies of planning, or the desire to get a certain effect in the elevations, are apt to lead to the disregard of one or other of what appear when taken by themselves to be somewhat unimportant points, but it is only by a vigorous adherence to what has been ascertained to be best, and when necessary sacrificing effect, that a result can be secured that will satisfy all the demands of modern hygienic science.

Much can, however, be done by keeping in view in the early stages of the design the various requirements of the class-rooms, and there are many buildings to show that due regard to provision for health need not necessarily have any adverse influence upon the appearance of the building.

The Number of Pupils in a Class.—This varies not only with the school, but with different parts of the same school. In the middle and lower forms the classes are usually larger than those in the upper part of the school. The Prussian regulations require that in a Gymnasium the maximum number of a class shall not in the upper divisions exceed 30, in the middle 40, and in the lower 50. These are rather larger numbers than would be found in a First Grade Secondary School in this country, and as a matter of fact they by no means always reach these figures in Germany. The number of pupils in a class in Secondary Schools in this country is not as a rule above 30.

Taking a few schools at random from the Public Schools Year

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* Health at School, p. 217.

Book, we find the average size of classes to be as follows :—Bradfield College, 20 ; Ipswich School, 20 ; Merchant Taylors', 25 ; Repton, 25 ; Rugby, 25 ; St Paul's, 18-20 ; Westminster, 20. In some of the other old schools, however, the number is very often larger. Taking fifty of our leading schools, there is an average of rather under 16 boys to a master, exclusive of music-masters. This cannot, however, be taken as a fair index to the size of the classes, as all the masters would not be teaching at one time. It is generally agreed that one teacher cannot properly manage and regularly teach a larger number than 30, though there should be one or more rooms capable of accommodating 40 or more, and there may well be some of a smaller size ; but, generally speaking, a class of from 25 to 30 may be considered about a standard size.

Having settled the number to be accommodated, the size and shape of the room depends—

1. On the floor space to be allowed per pupil.

2. On the size and form of desk employed, whether single or double desks.

3. On the method adopted in the arrangement of the desks, whether in single or double rows, size of gangways, &c.; the space taken up by the teacher's desk, blackboard, and cupboard, the fire or other heating apparatus, and the position of the door or doors.

4. On the distance of the desk farthest from the blackboard, *i.e.*, it must not be beyond the average sight distance.

5. On the necessity of so arranging the desks that all the pupils can see the master and blackboard easily, and also be seen themselves.

While there must be sufficient floor space allowed to make efficient ventilation easy—that is to say, it must not be necessary, in order to keep the room fresh, to change it at such a pace as to make perceptible draughts—at the same time it should not be larger than is absolutely necessary, in order to avoid a useless strain on the teacher's voice ; and, as pointed out in the chapter on ventilation, it is not so much on the size of the room that good ventilation depends, as on the methods adopted for the supply of fresh air.

As regards the distance at which the average boy can see distinctly the ordinary writing, about 1 in., on the blackboard, the following figures show the result of some experiments made in Germany by Zwez.* Of 81 children, 76 could read at a distance of 27 ft. 9 in., and

* Schulhygiene, A. Baginsky, 1898, p. 217.

54 at 46 ft. 3 in.; finally he comes to the conclusion that anything under 35 ft. would be safe enough, and at this distance the teacher should be well able to see what all the class were doing.

The shape of a class-room that is found to be most satisfactory is that of an oblong with the main light on one, the long side, and that, of course, the left, other windows being subsidiary and more for ventilation; these should never bring in a light strong enough to overpower that coming from the windows on the left. German authorities lay down careful rules as to the proportion between length and breadth—Zwez, that the breadth should be not less than $\frac{2}{3}$ and not more than $\frac{3}{4}$ of the length; Lang, that the most suitable proportion is 3 to 4; Erismann, again, from $\frac{2}{3}$ $\frac{3}{4}$ to 1.

The building construction regulations at Breslau lay down that the proportion of length to breadth must not be less than 5 to 3, and that the best form lies between this and the proportion of 4 to 3.

All authorities agree that the best form is an oblong with the lines of desks arranged at right angles to the long side. The exact shape and dimension of a class-room depend so much on the size and form of desks used, and their relative positions, that it seems hardly possible to lay down any hard-and-fast rule as to the proportion between length and breadth. On the whole, something near the proportion of 3 to 2 will give a satisfactory result.

A difficulty often arises in the arrangement of a class-room in small schools when the classes are too small to allow of a separate teacher to each. An oblong class-room to take 30 or 40 children may have been provided with the light on the left, but when the children are in two classes the teacher naturally wishes to have his desk in the middle, where a command of both can be best obtained. In order to get this the desks are arranged the long way of the room, with the result that the pupils have their backs to the light while the teacher is directly facing it. In order to obviate this, it is well to ascertain beforehand how the classes will be arranged, and, if two or more forms are to be placed in one room, to arrange that the lighting shall be, if possible, managed as in Fig. 11, with the main light from the end supplemented by a window at the back, but not placed opposite the teacher's desk.

School Desks.—In the Secondary Schools of this country and America, single desks are to be found as a general rule, arranged either in single rows, with space between every desk, or, where it is necessary to gain space, in double rows, that is, two desks side by side, which, while allowing easy ingress and egress, and permitting the teacher to get

easily to any pupil, economises a good deal of room by the omission of the extra gangways. This of course is much the same as using the double desk.

The difficulty of the question of desks lies in the very great variation in size among children during their time at school; not only the great differences natural to the considerable range of age, but the very great difference between children of the same age. Professor Bowditch of Harvard University, when making a careful investigation into the height and weight of nearly 25,000 school boys and girls of Boston, found the most surprising variations in the height of different pupils of the same age. These results are fully borne out by similar investigations in other parts of America and in Europe.* The results of his investigations showed a variation in children of the same age from 6 to 8 in.

This great variation in height at the same age makes the provision of desks varying in size obviously necessary, nor is it sufficient merely to have smaller desks in the lower form class-rooms, and so on, as it may easily happen that a big boy of eleven may be taller than a small boy of fifteen. It is commonly the plan to have two or three standard-sized desks to which, on the principle of the bed of Procrustes, the pupils have to accommodate themselves. The evils arising from continued use of badly designed desks, or of too great a disparity between the size of the desk and its occupant, are serious and long lasting. It should, however, be noted that the large differences are not as a rule common. Dr Kerr,† when measuring 1,600 children in five Elementary Schools in Bradford, found that 95 per cent. of the children came within $2\frac{1}{2}$ in. of three selected heights.

The variations in height and differences in rate of growth can only be provided for fully by the use of some sort of adjustable desk, that can be easily altered to suit the needs of different pupils. This is done to a very large extent in America. But such a plan naturally means a considerable amount of trouble, and may of course in certain schools be impracticable. If, however, it can be managed that every pupil in the school has a properly adjusted desk for ordinary use, or in a Boarding School, in their preparation or work room, the gain to the pupil is so great that it should outweigh any slight consideration of extra time or trouble. By having a simple contrivance for measurement, with a convenient and well-made type of desk, the trouble can

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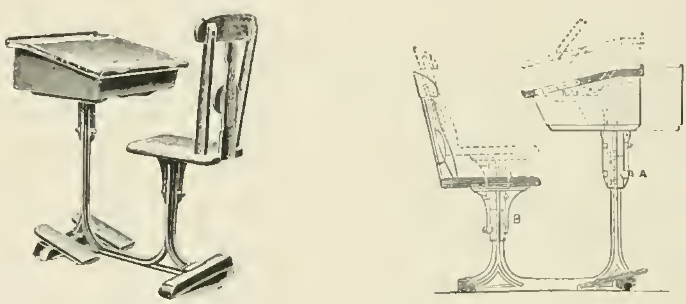
* Schulhygiene, Baginsky, p. 591, 1898.

† Journal of the Royal Statistical Society, Sept. 1897.

be reduced to a minimum, especially if it be done systematically at the beginning of each term. It should, however, be added, that although adjustable desks are in many ways admirable, and, as a rule, very strongly advocated by medical writers on school hygiene, they are by no means always looked upon with favour by Head Masters and Mistresses of schools, owing to the great number of practical difficulties that stand in the way. In many schools it is not possible to arrange that the same boy or girl shall always occupy the same seat; classes are continually changing rooms, sometimes two or three times in a morning. Then again a constant and watchful eye must be kept upon such desks, or they may easily be more productive of harm than the ordinary form. Either the desk or the seat may slip down, a not un-



1. The Glendenning Adjustable Desk.

likely contingency under the manipulation of the ordinary school boy or girl, and may be unnoticed for a time.

An excellent form of adjustable desk is that invented by Dr M. Roth, and exhibited, I believe, first at the Health Exhibition. The desk shown in Fig. 1, made by the North of England School Furnishing Company, embodies the principles advocated by Dr Roth, and shows the method of working. The slope of the desk for writing is fifteen degrees, and for reading forty degrees.

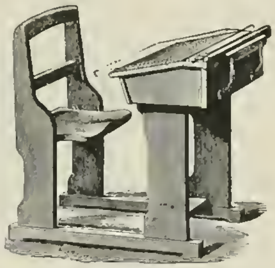
By means of a key and nuts on the columns supporting both seat and desk, either can be altered to any desired height, the desk itself being adjustable for horizontal distance. There are provided foot-rests, one on each side. It is probably better to adjust the height for the floor and omit these rests, since no child is the least likely to keep his or her feet upon them for more than a short time.

The most important factor in determining the comfort and suitability of the desk, after the question of height has been disposed of, is

the distance in a horizontal direction between the edge of the seat and the inner edge of the desk (see Fig. 2).

If the end of the desk projects over the edge of the seat, the overlapping part is known as "plus," and where there is a space between the two as "minus" distance. If a perpendicular line dropped from the edge of the desk just touches the edge of the seat, it is said to be "zero." This last, or a plus position, is usually considered the best, a minus position in any degree being bad (see Fig. 2). In order to keep this distance, and yet not make it too difficult for the pupil to get in and out, desks are made with a sliding top, the pupil, after being seated, pulling the desk in towards himself (see Fig. 3). This desk is often adopted in girls' schools with satisfactory results. It is hardly worth while laying stress on the fact of the necessity for great strength and simplicity, in the case of mechanism in school furniture, to withstand

2. Diagram to Illustrate Measurements of Desks.



3. The "Louise" Desk with Sliding Top (Hammer & Co.).

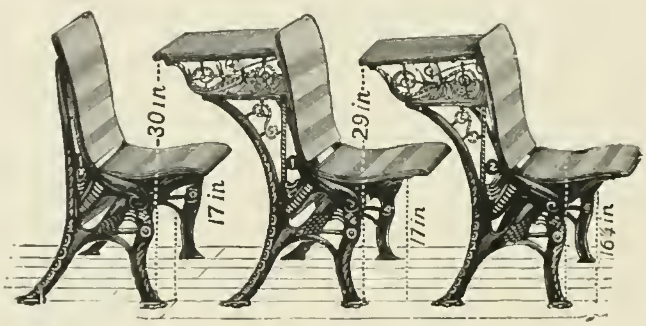
the wear and tear of school life and the persevering ingenuity of the schoolboy. Many forms of desks which work admirably in the shop soon succumb under this test. Desks known as "convertible," of which the top turns over to form a back or table, are as a rule to be carefully avoided. The different forms and patterns of desks are endless, and whether box desks or open desks are to be preferred depends of course on the school.

For the purpose of settling the dimensions of a class-room, the outside measurements of the desk and seat together are all that are necessary; in the case of desks with movable tops the measurement must of course be taken when open; 1 or 2 in. must be allowed between desks placed one behind the other to prevent shaking. The measurements of the different parts of school desks have been worked out with extraordinary care in Germany, and various writers lay down the dimensions necessary for pupils of different ages and heights worked

out to small fractions of a centimetre. The differences between the different writers are not great. According to Spiers, every school should be provided with standard desks of nine different sizes, of which every class-room should have three, these standard sizes to range from 1 ft. $7\frac{3}{4}$ in. to 1 ft. $11\frac{1}{2}$ in.* in breadth, the depth reckoning seat and desk together from 2 ft. $2\frac{1}{2}$ in. to 3 ft. $0\frac{1}{2}$ in.

Dr Baginsky, in his book upon School Hygiene, gives a large number of tables collected from all the German authorities, at the end of which he comes to much the same conclusions in regard to breadth, but slightly less in depth.

Dr Clement Dukes demands 2 ft. in breadth for the desk, which should be from 15 in. to 2 ft. in depth, with a seat of 12 in.



4. THE CANADIAN DESK.

The following table gives an approximate idea of the different sizes of desks and seats for different ages.† These dimensions apply to desks of the pattern in Fig. 4.

Size.	Height of Seat.	Height of Top.	Width of Top	Length.	Floor Space.	Age Accommodated.
1	17 in.	30 in.	16 in.	24 in.	28 in.	ADULTS.
2	$16\frac{1}{4}$ in.	29 in.	16 in.	24 in.	27 in.	16 to 21
3	$15\frac{1}{4}$ in.	$27\frac{1}{4}$ in.	14 in.	22 in.	26 in.	12 to 18
4	$14\frac{1}{4}$ in.	$25\frac{1}{4}$ in.	14 in.	22 in.	24 in.	10 to 15
5	$13\frac{1}{4}$ in.	23 in.	12 in.	20 in.	22 in.	8 to 12
6	12 in.	21 in.	12 in.	20 in.	21 in.	5 to 8

Taking into account the different shapes and sizes of desks, and the different measurements demanded by different authorities, it will be

* These dimensions are approximate, being turned from metres and centimetres to feet and inches to facilitate comparison.

† Taken from the Catalogue of the North of England School Furnishing Company.

found that for a full-sized desk in a Secondary School—that is to say, one capable of accommodating pupils up to the age of seventeen or eighteen—measurements of 2 ft. in breadth by 3 ft. in depth will be a sufficient allowance, while for the younger pupils about 1 ft. 7 in. by 2 ft. 3 in. This is the size usually allowed in the Elementary Schools when the double desks are 3 ft. 4 in. wide, 2 ft. 3 in. deep.*

Arrangement of Desks.—Care should be exercised to see that the desks in a class-room are suitably arranged. The common plan of placing one row of desks against the window wall is one to be avoided. In the first place, the light will be caught by the window-sills, and the desks immediately under will be in shadow ; secondly, there will always in cold weather be a draught from the surface of the glass descending directly on the heads of those sitting under the windows. A space at least equal to the gangways, say 18 in., should be kept between the outer wall and the nearest line of desks. The gangways between the desks should be from 18 to 20 in. when single desks are used ; in the case of double desks or single desks in pairs the distance should be increased to 2 ft.

In rooms arranged so that the door does not open into space in front of the desks, it will be necessary to provide a gangway at least 3 ft. wide leading to the door. In this connection it should be remembered that a badly placed door thus reduces the seating capacity of the room. The last row of desks should not be placed against the back wall of the room, but a space of 12 in. left so that it may be possible for the teacher to pass behind. A width of 18 in. again should be left between the inner wall and the desks.

It may of course, in the case of an old building, where the windows are unsuitably arranged, be necessary to vary the arrangement in order to get the best advantage of what light there is ; if so, convenience of ingress and egress must be sacrificed in order to get a good left-hand light ; if this, as is often the case, is prevented by the position of the fireplace, a right-hand light should be preferred to any arrangement which brings the light directly on the faces or behind the pupils.

Dimensions of Class-rooms and Floor Area Required.—The Board of Education in their regulations for the planning of Secondary Schools have laid down that in class-rooms there should be not less than 18 sq. ft. per head, or as an alternative 12 sq. ft. for

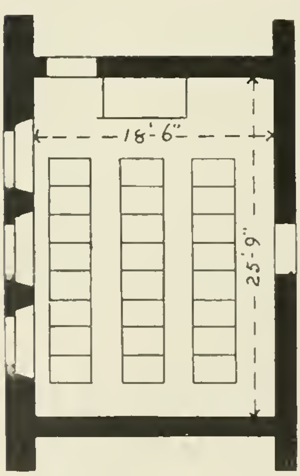
* See Appendix A, Day School Code.

each pupil, and a space not less than 7 ft. 6 in. in depth and of the full width of the room for the teacher. The latter arrangement will be found to provide about 17 sq. ft. per head when the classes are above twenty-five.

This implies single desks with gangways each side. If, however, double desks are used or single desks placed close together, the amount may be reduced to 16 sq. ft.

When the size of the classes is large the amount of floor space per head can be proportionately decreased, and when the number reaches forty or more, 15 sq. ft. will allow for any arrangement of desks.

Mr Shaw, in his book on School Hygiene, published in 1901, says, speaking of class-rooms—"Certain conclusions with reference to their size have at last been reached, and these conclusions have been so thoroughly tested and sanctioned by the most careful schoolmen as to warrant their being regarded as standards. These standards are the results of investigations and repeated experiments, in which lighting, heating, ventilating, the needs of the child as to eye and ear, and other physical requirements, have been considered. They are the outcome of the special knowledge and recommendations of physicians, architects, and engineers, and of the practical judgment of schoolmen, after repeated test and modification. These standards demand in the first place 15 sq. ft. of floor space and 200 cub. ft. of air space for each pupil as the least amount of floor space and air space possible for a schoolroom when all the needs of health are fairly considered."



5. German Class-room.

This it should be remembered refers to the comparatively large classes of American Schools, but in many of the more recent Schools in the United States an allowance of 20 ft. or more will commonly be found.

In Germany the amount allowed for the younger children is much the same as in our Elementary Schools. An example of class-room for forty-eight younger children is shown in Fig. 5; this room, measuring 25 ft. 9 in. by 18 ft. 6 in., gives almost 10 sq. ft. per head. In their rooms for older children the amount rises, and as soon as the Higher Schools are reached it is not uncommon to find 18 to 20 sq. ft. per head provided.

As far as questions of health are concerned, 15 sq. ft. of floor space will give a sufficient allowance of air, provided that some fairly efficient means of ventilation are provided,

but, as soon as the numbers in the class are reduced below thirty, other factors become important. The provision of the necessary space for the teacher, gangways and spaces between the hall and desks, involves an increased allowance of floor space per head.

The amount of floor space provided in some typical schools in Germany, England, and America is shown in the table given below. The measurements of those of the German Schools have been turned from metres into feet and inches for the sake of comparison.

	No. in Class.	Length. Ft.	Length. In.	Breadth. Ft.	Breadth. In.	Sq. ft. per Head.
Höhere Bürgerschule	36	24	1¼	18	4¼	15
XII. Realschule, Berlin	40	29	6¼	19	8¼	15
New Building, Lessing's Gymnasium, Berlin (Lower Forms)	48	29	6¼	21	4	13
New Building, Lessing's Gymnasium, Berlin (Upper Forms)	42	29	6¼	21	4	15
Realschule, Karlsruhe	36	31	3¾	19	8¼	17
Sekundarschulhaus, Zürich	42	36	0	22	11½	20
Töchterschule, Basle	36	27	10¾	21	4	16
Mädchenschulhaus, Zürich	48	37	0	22	11½	17
Boston High School	42	32	0	28	0	21
Do. do	81	40	0	38	0	18¾
Professional High School, Pantuchet (Working Room)	49	32	0	32	0	21
Professional High School, Pantuchet (Recitation Room)	32	22	6	21	0	15
Schools of the Girls' Public Day School Company	30	21	0	19	6	13½
School for Boys, Barnard's Inn	30	24	3	23	0	18½
Judd Commercial School	24	20	0	20	0	16½
St Paul's, West Kensington	40	29	0	24	0	17½
City of London Schools	40	24	0	22	0	13½

Dr Clement Dukes* maintains that a class-room to hold 30 boys should be at least 40 ft. long, 25 ft. wide, and 16 ft. high. This would give over 33 ft. of floor space for each boy, a surely unnecessarily large allowance if any means of ventilation are provided at all. The cost of building, were such space to be provided, would become almost prohibitive. Though of course it would be pleasant to work in, the height of 16 ft. seems most unnecessary. Any air space above 12 ft. is of no use as regards ventilation, as it remains unaffected by movements of the lower air in the room, nor is it required for light.

* It should be noted that, in the new edition (1905) of his book, Dr Dukes adopts the area of 18 sq. ft., as laid down by the Board of Education for Secondary Schools.

A room 25 ft. wide, where the desks are not actually against the inner wall, can be perfectly lit with a height of 13 ft.

But these dimensions are far surpassed by another writer on School Hygiene. Dr C. E. Shelley, Medical Officer at Haileybury College, in an article on the subject, gives the following recommendation: "The size of the room (class-room) can be calculated by allowing at least 800 cub. ft. for each inmate, reckoning not more than 12 ft. of wall height in doing so, and thus allowing 70 sq. ft. of floor space to each pupil." * While allowing that this may seem an extravagant allowance, Dr Shelley advances a number of arguments in its favour. But although interesting as showing to what lengths medical writers will go in the demand for cubic air space, it is difficult to regard it as a practical recommendation. On this scale a class-room for 30 pupils would measure 60 ft. by 35 ft. Such a room would be impossible to light, as the height was limited to 12 ft.,† unless windows were placed on three sides at least, and only a few of the pupils, unless gifted with abnormally long sight, could read anything on the blackboard; the master could not make himself heard without a serious strain on his voice. The health of the master seems often overlooked in the anxiety for a very large allowance of space for the pupils. The additional cost of heating rooms of so great a size, and the additional expense, not only in the building but the maintenance of such a school, would hardly be compensated for by the rather doubtful advantages of a building designed on this scale. The building regulations issued by the Board of Education require not less than 15 sq. ft. per head in the case of Higher Elementary Schools, the size of the class being limited to forty.

If, as stated above, 15 sq. ft. be allowed for the maximum number for which the class-room is designed, the room may be considered to fairly fulfil the conditions demanded by sanitary science. If more can be provided, the results are no doubt better, but probably 20 sq. ft. should be regarded as a limit (see Fig. 6). Above that amount the extra heating required, and the additional strain on the teacher's voice, make the increase of room a doubtful advantage.

In settling the sizes of the classes and the dimensions of the class-rooms in a building there are several points to consider in order to avoid waste of space, which become of considerable importance in the case

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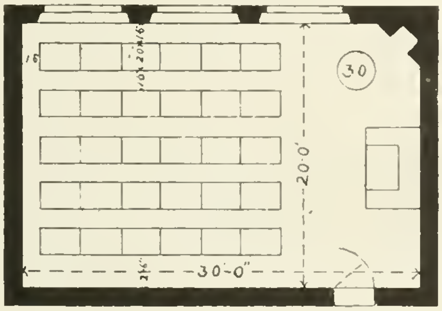
* Articles on School Hygiene, *The School World*, August 1899.

† It is suggested that the lowness of the rooms will enable a considerable saving in the cost of building, additional height being of no use for ventilation.

of a building where it is necessary on financial grounds to take full advantage of every square foot of space. The total area of class-room is usually governed by the amount of superficial floor area to be allowed per pupil. Unless this amount is so large as to make the arrangement of desks immaterial, the exact dimensions of the length in proportion to the breadth should depend upon the form of desks that are to be used. For example, if 15 sq. ft. be determined upon as the floor space to be allowed, a class-room for 48 pupils will require 720 sq. ft. This will be provided by a room measuring 32 ft. by 22 ft. 6 in. Now, if single desks are used, it will be found that according to the measurements given below there is exactly room for 6 rows of desks 8 deep, allowing for gangways, master's desk, &c. If, on the other hand, the room had been made say 29 by 25 ft., the necessary area or rather more is still provided; but when the desks come to be put in, it will be found that there is not quite enough space to allow of an extra row of desks in the width of the room, thus necessitating another line in depth, so that, while there is a waste of space down the side of the room, there is not sufficient room for the master and his desk. On the other hand, by keeping these dimensions and substituting double desks, there will be just room for 4 double desks in the width, and, as this gives 8 places in the width, there will only be 6 rows in depth, so that plenty of room will be left for the master. A room measuring say 30 by 24 ft. will suit neither single nor double desks without putting them too close together, or not leaving room for the master's platform. This will be made clear by looking at Figs. 7 and 8. Of course, if widths for the gangways, &c., different to those given above are determined upon, the same questions arise, but naturally with different figures. In any case, a more satisfactory plan can be produced if the type of desk be settled beforehand. A somewhat similar question arises in determining the different sizes of the classes that are to serve as the units for the class-rooms. These numbers should be arranged to suit the type of desk that is to be used. For example, if single desks are used, a class of 20 conveniently splits up into 4 rows of desks 5 deep. On the other hand, with double desks it would be necessary to make the



6. Class-room giving 20 sq. ft. per Head.

number 18 or 24 in order to get a complete number of rows—that is, 3 double desks in a row 3 deep or 4 deep. If single desks are used, it will be found economical to make the units for the class-rooms 15, 20, 25, 30, 35, 40, 48; while double desks can be more conveniently arranged with classes of 18, 24, 30, 36, 42, 48.

Again, since the plan of a school generally involves a long row of class-rooms of the same width but of different lengths to suit the varying numbers of the different classes, the question as to the most convenient dimension for their width becomes of some importance. To give instructions to the architect to provide so many class-rooms of such and such sizes without reference to anything but floor space will not improbably result in forcing him to waste a certain amount of space, whereas, if, as mentioned above, the form of desk be first settled, and then the width that will take a convenient number of the desks, all the class-rooms can be settled to take a multiple of that number. For example, if single desks are used, and a row of 5 desks be considered a convenient width, the classes would run in multiples of 5—15, 20, 25, 30, &c., making 3, 4, 5, and 6 rows in depth; if double desks are used, 3 pairs of desks make a convenient width, until it is necessary to provide for larger numbers, so that in this case the class-rooms should be built for multiples of 6. The fact that classes are seldom found of the exact number which the room is intended to take does not affect the question, as it is the initial waste of space involved in providing for inconvenient numbers that is to be avoided.

All this may seem very obvious, and the differences insignificant, but in the first place it is so common to see in the instructions for a new building merely the numbers that the different class-rooms are to hold given with no reference to anything but floor space, that it has been considered worth while to draw attention to these points. In the second, while it is true that in buildings put up without much regard to expense, with large class-rooms giving a generous allowance of floor space, and leaving the matter of desks to chance, on the ground that there is plenty of room, such details are naturally of small consequence; but in a school building, when every foot of space and every penny in the cost has to be carefully considered, such a question should assume great importance, since a waste of only 18 in. down the length of the class-rooms of a school having say 12 class-rooms of an average length of 20 ft. would mean an area of 300 sq. ft.—that is to say, a sufficient space to provide an additional class-room.

For the master's desk and platform at least 8 ft. must be provided.

In the case of a wide class-room more will be necessary, in order to allow the master to see the whole class at once. A shallow class-room necessarily involves loss of effectual area, as the necessary width for the master has to be continued across the greater dimension of the room instead of the narrower. A class-room will then work out as follows :—

	Ft	In.
Width of desk (full size) - - -	2	0
„ of gangway for single desks - - -	1	6
„ of gangway for double desks - -	2	0
„ of gangways next wall - - -	1	6
If there is a door in the wall and passage room to be provided, the inner gangway next wall - - - - - -	3	0
Length over desk and seat together, allowing for space between - - - - -	3	0
Space behind back row - - - -	1	0
Space for master's platform at desk - -	8	0

If these measurements are taken, it will be found that for small numbers considerably more, and in large classes at least 15 sq. ft. per head, will be provided. For example, a class of 25, arranged in 5 rows of 5 (see Fig. 7, c) :—

WIDTH.

	Ft.	In.
5 rows, 2 ft. wide - - - - -	10	0
6 gangways, 1 ft. 6 in. - - - -	9	0
	19	0

LENGTH.

Master's desk and open space - - -	8	0
5 rows, 3 ft. deep - - - - -	15	0
Space behind last row - - - -	1	0
	24	0

giving a room 19 ft. by 24 ft., making 456 sq. ft., or 18 sq. ft. per head.

In Figs. 7 and 8 are given a number of examples of class-rooms worked out upon the figures given above as the width of gangways, &c., accompanied by two tables showing the sizes of rooms, arrangement of desks for class-rooms, based upon the 18 sq. feet required in

Secondary Schools, and the 15 sq. ft. that is provided in the Higher Elementary Schools. The height of the rooms is throughout reckoned at 13 ft.

The sizes given for the windows are arranged to correspond with the figures given in the latter part of this chapter (see page 84), and give in each case a proportion of window opening of 1 to 4 with regard to the floor area. The positions of the windows, fireplace, and door are also based upon the conclusions come to in this chapter. These positions are, for all window openings, the left-hand side of the pupils as they sit; for fireplaces, in the angle to the right of the teacher, and therefore on the window side of the room; and for doors, at the teacher's end of the room on his left.

DIMENSIONS OF CLASS-ROOMS.

I. Single Desks.

No. in Class.	Arrangement.		Length.		Breadth.		Height.	Area.	Approximate Floor Space per Head.	Windows.	
										No.	Size.
	Wide.	Deep.	Ft.	In.	Ft.	In.	Ft.	Sq. ft.	Sq. ft.		Ft. In. Ft. In.
*20	4 rows of	5	23	6	15	6	13	364	18	3	3 9 × 8 6
*25	5 ,,	5	23	6	19	0	13	446	18	3	4 6 × 8 6
*30	5 ,,	6	26	6	19	0	13	503	$16\frac{2}{3}$	3	5 0 × 8 6
35	5 ,,	7	29	6	19	0	13	560	16	3	5 6 × 8 6
40	5 ,,	8	32	6	19	0	13	617	$15\frac{1}{4}$	4	4 6 × 8 6
48	6 ,,	8	32	6	22	6	13	731	$15\frac{1}{4}$	4	5 0 × 8 6

II. Double Desks (to provide not less than 15 sq. ft. per head).

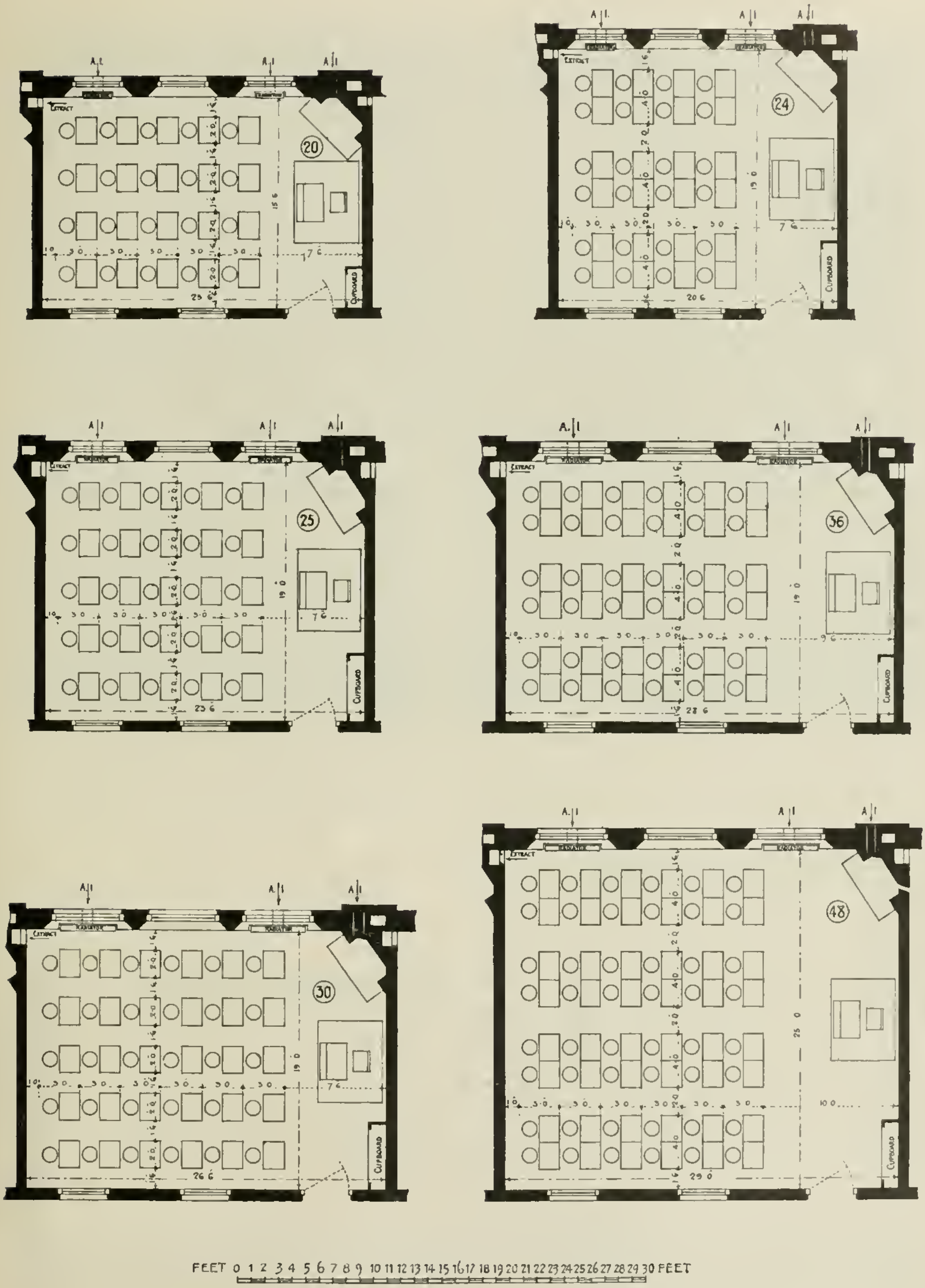
No. in Class.	Wide.	Deep.	Length Ft.	In.	Breadth Ft.	In.	Height Ft.	Area Sq. ft.	Floor Space Sq. ft.	Windows No.	Size
16	2 rows of	4	20	6	13	0	13	266	$16\frac{2}{3}$	3	3 3 × 8 6
†24	3 ,,	4	20	6	19	0	13	389	16	3	3 9 × 8 6
30	3 ,,	5	23	9	19	0	13	451	15	3	4 6 × 8 6
†36	3 ,,	6	28	6	19	0	13	541	15	3	5 6 × 8 6
42	3 ,,	7	33	0	19	0	13	627	15	4	4 6 × 8 6
†48	4 ,,	6	29	0	25	0	13	725	15	3	6 6 × 8 6

III. Double Desks.

Minimum dimensions to allow of sufficient room for gangways, &c.

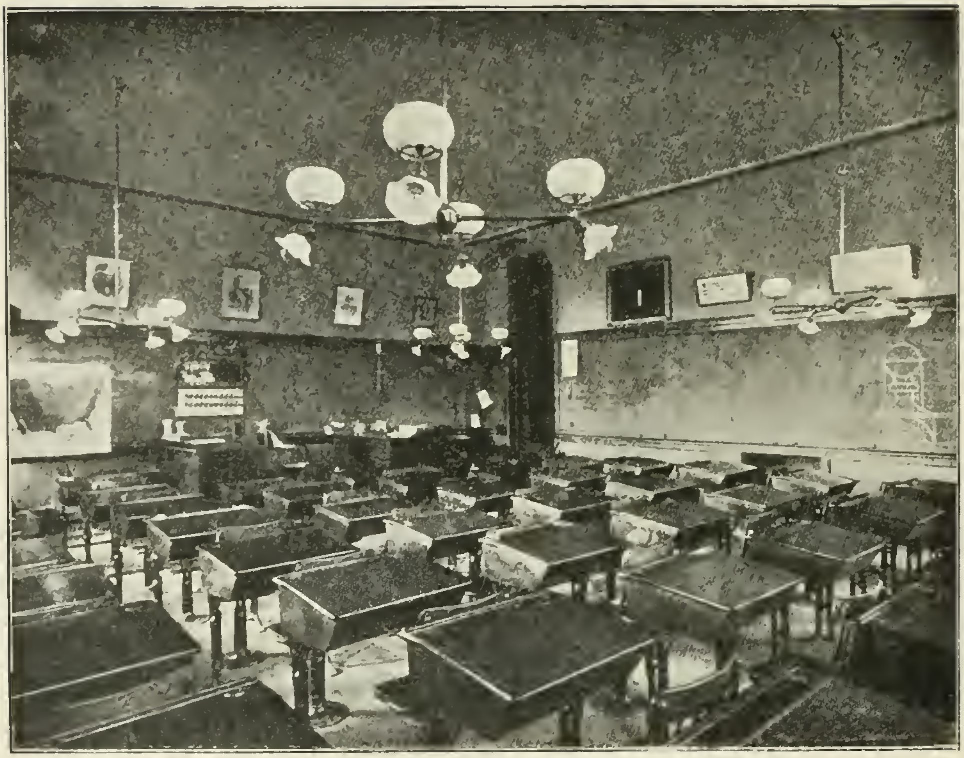
No. in Class.	Wide.	Deep.	Length Ft.	In.	Breadth Ft.	In.	Height Ft.	Area Sq. ft.	Floor Space Sq. ft.	Windows No.	Size
16	2 rows of	4	20	6	13	0	13	266	$16\frac{2}{3}$	3	3 3 × 8 6
24	3 ,,	4	20	6	19	0	13	389	16	3	3 9 × 8 6
30	3 ,,	5	23	6	19	0	13	446	$14\frac{2}{3}$	3	4 6 × 8 6
36	3 ,,	6	26	6	19	0	13	503	14	3	5 0 × 8 6
42	3 ,,	7	29	6	19	0	13	560	$13\frac{1}{3}$	3	5 6 × 8 6
48	4 ,,	6	26	6	25	0	13	662	$13\frac{3}{4}$	3	6 0 × 8 6

* See Fig. 7. † See Fig. 8.

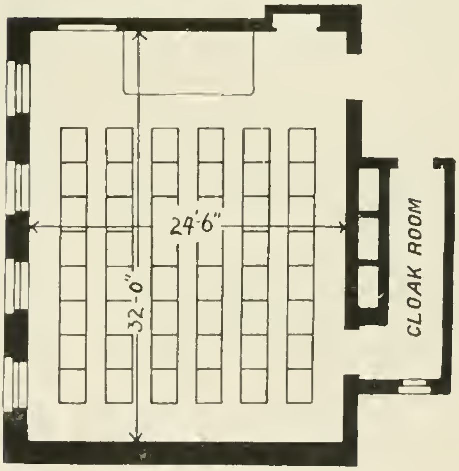


7. Single Desks. 8. Double Desks.

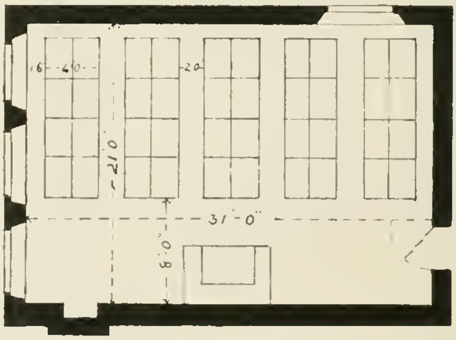
To illustrate Tables on page 68.



9. INTERIOR VIEW OF AN AMERICAN CLASS-ROOM.



10. AN AMERICAN CLASS-ROOM FOR FORTY-EIGHT PUPILS.



11. SHALLOW CLASS-ROOM FOR FORTY.

In Fig. 10 is shown the plan of an American class-room, but it is not easy to compare an American School class-room with either an English or a German room. In the newer High Schools in America it is customary to provide a very large amount of floor space per head—for example, in the Boston High School there is given over 21 sq. ft.; but it must be remembered that these rooms are used by the pupils for private work, the actual teaching being usually carried on in smaller rooms called recitation-rooms, so that the objections to class-rooms of too large an area do not strictly apply to such rooms.

In the case of a shallow class-room it is necessary to supply additional light at the back. In this case the window should be placed at the end of the room as in Fig. 11, in order that it should not be opposite the teacher (see also Fig. 19).

It is sometimes an advantage, in arranging the desks in a room intended for young children, to provide for a semicircle of seats in front of the master's desk in addition to the regular desks for writing work. This enables the class to be called out for oral work, making a pleasant change of position, and enabling the master, if he wishes, to stimulate the work by place-taking, &c.

The arrangement of a class-room for "criticism" lessons, required for student-teachers, is given when dealing with Training and Practising Schools.

Height of Class-rooms.—The height of the class-room depends (1) on the distance which it is necessary for the light from the side windows to go; (2) on the cubical space to be provided for each pupil. From the point of view of ventilation, 13 ft. may be considered ample. A common rule is that the breadth of the room should not exceed twice the clear height. In the regulations issued by the Board of Education it is laid down that in a room 14 ft. high any space beyond 24 ft. from the window wall is insufficiently lighted. But it is usually held that a room 13 ft. high can safely be made 25 ft. wide, and if the seats are arranged with a gangway next the inner wall 2 ft. 6 in. or 3 ft. wide, a less height than 13 ft. will be sufficient for the purpose of effective lighting, since the farthest desk from the window will be under 23 ft. The height allowed in German Schools varies from 13 ft. to 13 ft. 6 in.; as, for instance, in Berlin, the Falk Gymnasium, 13 ft. 6 in.; the Lessing Gymnasium, 13 ft.; the last-built Realschule and the Höhere Mädchenschule are both 13 ft. 1 in. Much the same measurements prevail in the more recent Elementary Schools. In some Elementary Schools, however, in Berlin, it is as low as 12 ft.

In this country there is a tendency to allow rather more height, but it may fairly be assumed that 13 ft. is sufficient, the height of a room being governed really by the question of light. Where the rooms are not more than 20 ft. wide, a rather less height may be allowed; over a width of 25 ft. the height must be increased above 13 ft. to effectually light the side opposite the window.

Doors.—The doors to a class-room should be wide enough to allow of the necessary furniture being taken in and out, say from 3 ft. to 3 ft. 3 in. Their number and position naturally depend on the rest of the plan of the school. The best and, as far as space is concerned, most economical position is close to the teacher's end of the room, so avoiding the necessity of a wide gangway. The upper panels of the class-room doors are often glazed with clear glass, to allow of the Principal inspecting the classes without disturbing the class. This is not always approved of, and it is as well that the question should be settled when building.

A fanlight or hopper ventilator should always be placed over the door for ventilation purposes, the full width of the door.

Raised Seats.—The plan of raising the three rows at the back of the room by means of steps, though apparently having advantages in enabling the pupils in the back rows to see better, and usually adopted in Elementary Schools where the numbers in the classes are of course very much larger, is not found to be satisfactory in Secondary Schools, for many reasons. The desks must be fixed to prevent their being pushed or slipping over the edge; this makes efficient cleaning impossible; the top of the desk and some 9 or 10 in. below are invisible to the teacher unless a person of unusual height, so that effectual supervision cannot be kept. The steps having to be of considerable length, 2 ft. 6 in. to 3 ft., make it difficult to move up and down, and, as there is usually a hollow space underneath the raised part, the noise is very great. Finally, it is urged that there is so much taken away from the cubic capacity of the room, though this is probably not of great importance.* In lecture-rooms, where it is necessary for every one to see the top of the demonstration table during lessons, it is of course necessary to have raised seats. The better plan in ordinary class-rooms is to have the teacher's desk and seat on a platform raised a little above the floor.

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* If the seats are much raised it becomes easy for the pupils to see and copy the work of those in front.

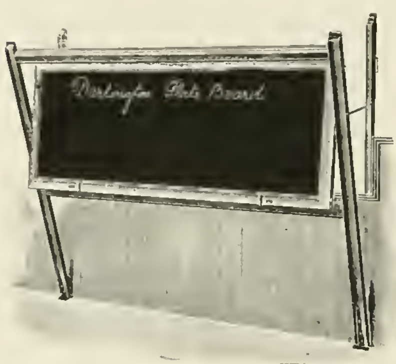
but not more than 6 or 8 in. The only rooms in which galleries are now used are as a rule those for very small children, and known usually as babies' rooms (see Fig. 300). An infant school has as a rule one room arranged with a semicircular raised gallery; this is, however, often objected to, and is now less often found.

The Fireplace.—The position of the fireplace, where this form of heating is in use, is of considerable importance. The centre of the wall behind the teacher is a very inconvenient place for the fire, as it interferes both with the position of the teacher and of the blackboard. The position shown in the figures (Figs. 7 and 8), where the fireplace is on the right of the teacher and the door on the left near the end of the room, has many advantages. The fireplace is then well out of the way—it is on the cold, *i.e.*, the window side of the room, and so is in an advantageous position for warming; and should it be a ventilating grate, it can draw its necessary supply of fresh air with the smallest length of duct. It is objected against this position that it puts the teacher in an unpleasant draught, since he is then in a direct line between the door and fireplace, and if there is no provision for the entrance of air beyond the cracks under the door, &c., this is no doubt the case; but provided there is other provision for air, or if a ventilating grate be used, little objection will be found on this score, more especially if the corridors or hall from which the class-rooms open are kept up to a moderate temperature. Probably the next best position, and one that is often preferred, is on the left of the teacher (see Fig. 30). If the entrance door is close to the fire, the danger of dresses catching fire, in the case of Girls' Schools, should not be overlooked.

The Blackboard.—This very important piece of furniture should be fixed, and as large as possible. Movable blackboards are most inconvenient and troublesome things. In lecture-rooms it is convenient to have a large blackboard that will run up and down in grooves. A method of hanging a board that allows the best use to be made of the light is shown in Fig. 12; this can also be reversed. In this country it is usual to supply a blackboard for the teacher only, while in America work is done upon the blackboard, which is carried right round the room, by all the pupils; the usual height being 3 to 4 ft. according to grades. This supply of almost unlimited blackboard is spoken of very highly from the educational advantages gained by being able to send children to work at it. Apart from this it is a great boon to the teacher, as it is then possible to leave up what has been written, not only for the lesson,

but even for days if wished, while a small blackboard necessitates erasure of what has been written before anything new can be put on.

The best material for a blackboard is probably roughened glass coloured black or dark green at the back, though the objection to this is that it wears away the chalk so quickly that it is difficult to keep a point for writing. Next to this, dark green or black slate. It should be of some material that can be easily washed. Where expense prohibits a sufficiently large provision, a fairly effective substitute can be made by the use of strong Manila paper blackened. Attempts are often made to treat the wall with various arrangements of cement blacked. The makers usually promise that this will keep its colour, but so far the results have not been successful. Of the many different kinds that I have come across, none—even some that had been recently done —had kept anything like a black surface. A grey surface is injurious to the eyes. Various makers of school apparatus have substitutes for the ordinary wooden blackboards, some of which are satisfactory. A material called the Darlington slateboard is one of the most successful, as it improves with use, and does not reflect the light unpleasantly. There should be under the board a chalk trough about $2\frac{1}{2}$ in. wide; it will save a good deal of dust if this is covered by an open woven wire cover, which can be taken off for cleaning. It will be found a great convenience, when there is not a blackboard running all round the room, to provide two flat wooden rails let into the walls, about 2 in. deep and about 2 ft. apart, the lower at the height of the dado. These may be carried round all the available wall space in the class-room to serve to pin up on all kinds of things—notices, good work done by some pupils, time-tables, &c.; if they are let in flush with the wall, black paper pinned upon them will serve for extra blackboard. There should also be a picture rail fixed round the walls. A rail fastened on the floor at a distance of 6 in. from the wall is a useful precaution. In the first place, it prevents the desks being put actually touching the walls—a common habit; and secondly, when the desks are moved about for cleaning or rearrangement, it prevents holes being knocked in the wall. The plan of rounding the angles between the walls and floor and ceiling as in a hospital, to make effective cleaning easier, is sometimes found and recommended by medical authorities.



12. MOVABLE BLACKBOARD.

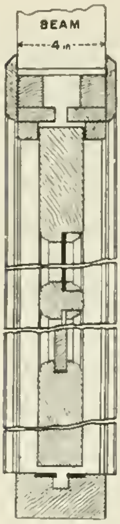
A thermometer should be found in every class-room, and the temperature entered upon a chart at the opening and closing of school. This will be found of great assistance in case of complaints as to cold and heat, &c. It should not be placed on a wall, as that is usually colder than the air in the room, especially if the room is heated by hot air. A common plan is to hang it to the gas pendants. In the newer Berlin Schools it is so arranged with a glass panel in the wall that the school keeper or porter can see how the temperature in the class-rooms stands without disturbing the class.

13. The Climax Partition (half open).

Sliding Partitions.—Sliding partitions for the purpose of dividing the class-rooms so that they can be thrown together when desired, are made in many forms, almost every maker of school furniture having a pattern of his own. The two methods illustrated here have been extensively tried with success. The principle upon which they are both based enables them to be shut up flat against the wall, and so to occupy a very small space when closed. In Figs. 13 and 14 is shown the form of partition made by the North of England School Furnishing Company. A noticeable feature of this partition lies in the arrangement of the runners. The weight of the partition is carried by the floor (see Fig. 15) and moves upon ball bearings; the advantage claimed for this

14. The Climax Partition (shut).

is freedom from any liability to sticking, such as might be caused by the sagging of a beam if used to support the partition—the sill in the floor only requires a depth of two inches.



15. The Climax Partition.

Another widely used partition is that made by Messrs Peace & Norquoy (see Fig. 16). The method of working this partition also enables it to be shut up against the wall. In either case it is possible to put in a door whenever it may be desirable. The method of separating class-rooms by sliding partitions is rather on the decrease now, as the custom of having a responsible teacher in charge of each form is becoming more common; but their use to cut the class-rooms off from a hall, so that the size can be easily enlarged by throwing the class-rooms into it, is perhaps on the increase. In some American Schools the rooms are so arranged that it is possible to clear a whole floor in this way. Where the organisation of the school does not require the daily use of a hall, this method is, no doubt, an advantage, as a large room can be made at any time for the purpose of any social function or assembly of the school, while avoiding the expense of building a large room for the purpose. It is, however, unlikely that such a plan would be regarded with favour in this country.

16. Sliding Partition—Messrs Peace & Norquoy.

ELEMENTARY SCHOOL CLASS-ROOMS.

It has been considered best to consider the class-rooms for Elementary Schools in this place, although this part of the book is devoted to Secondary Schools, since so many of the questions, such as

lighting, &c., requiring to be dealt with are the same for both kinds of schools, whilst the dimensions of desks and other measurements given for class-rooms in Secondary Schools are equally adapted for Higher Grade Schools, in which the Government regulations now require a floor space of 15 sq. ft. per pupil, and where the pupils stay until the age of sixteen or older. The chief difference between an Elementary School class-room and that of the Secondary lies in the relatively larger classes in the former, and the smaller amount of floor space that is generally provided. The size of desks provided is also of course smaller, as the children leave at the age of fourteen; though, as there are Evening Continuation Schools carried on at many schools, there is a good deal of discomfort caused by the smallness of the desks to the older scholars attending these classes.

Size of Classes.—This is to some extent dependent on the arrangement of teachers, *i.e.*, how far pupil teachers are made use of, &c. The tendency is now strongly in the direction of a properly certified teacher to every class, with a separate class-room.

In order to provide against the great loss of space necessarily caused by having all the class-rooms of one size, the London Board in 1900 adopted a definite grading of the accommodation of class-rooms, as far as new schools were concerned, on the basis that class-rooms for Standard VI. and over shall not accommodate more than 40 children; Standards IV. and V. not more than 50; and for Standards I., II., III., not more than 60. This has followed naturally from the regulations previously laid down by the Board in regard to the number of teachers required for the efficient staffing of schools, no one teacher being considered capable of taking more than 60. The custom still common of designing an Elementary School with the class-rooms all of one size, though doubtless a convenience from the point of view of planning, is strongly to be deprecated.

It is unusual to find in our new Elementary School classes of more than 60, though of course a class of 70 or even 80 may be occasionally necessary. In Germany there are somewhat similar-sized classes, though, as a rule, what difference there is, is in the direction of rather larger numbers. Dr Adolf Baginsky, after discussing the question at some length from the various points of view, the powers of supervision of the master, and the difficulties of ventilation, &c., in dealing with larger numbers, comes to the conclusion that the maximum number that should be allowed in one class is 60, also remarking that the maximum number allowed by the Government regulations in the different States is too high.

In the Frankfort regulations it is laid down that in a Public Elementary School one teacher can take 80 children. In Berlin the numbers are fixed at 69 for the lower classes, 60 for the middle, and 50 for the upper forms. In 1896 the average number in a class in the Public Elementary Schools in Berlin was 52.45. In Austria, by the Ministerial Decree of 1873, the maximum number is fixed at 80.

The amount of superficial area to be allowed per head is laid down by the regulations of the Board of Education as 10 ft. in the schools for older scholars, and 9 ft. for infant schools. This amount of floor space is universally adopted as a minimum in this country, as no school can get any of the Government grant which fails to comply with this requirement.

The plea that there is no reason why the allowance of floor space per head should be smaller in the case of Elementary than in Secondary Schools is of undoubted weight. It is argued that separate desks and effectual isolation of each child is of greater importance in the case of children of the class from which the majority of the Elementary pupils are drawn, and that, if 18 or 15 sq. ft. are really required upon hygienic grounds, the Elementary School child should be provided with it. This provision of floor space and single desks will be at all events feasible when the size of the classes in the Elementary Schools are reduced to 30, and the requisite number of additional teachers are available. But with the large classes at present found the arrangement is hardly possible; nor indeed is it necessary, when the numbers are large, to provide so great an amount of floor area per head.

In the Elementary Schools of Germany, as a rule, the amount of floor space per head is smaller than this. In four Elementary Schools of Berlin the amount allowed is between 8 and 9 ft.

The following table shows some amounts actually provided in Elementary Schools: *—

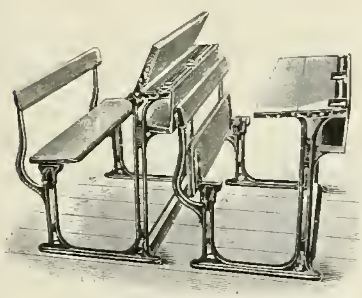
Prussia - - -	6.45 ft. (approximately).
Hesse - - -	8.60 „
Baden - - -	8.60 „
Wurtemberg - -	6.50 „
Saxony - - -	6.50 to 7.50 ft.

These figures are rather below that demanded by German writers and authorities. According to the *Aerztliches Gutachten*, *Elsass-Loth-*

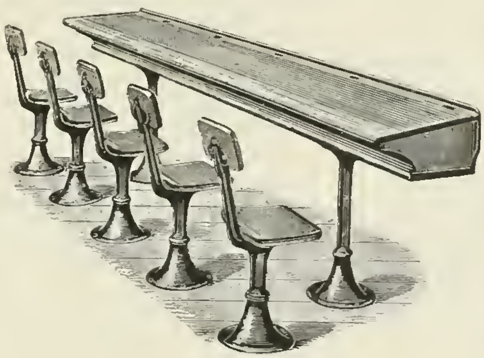
* Schulhygiene, Baginsky, 1898.

ringen, 1882, the amount allowed should be 1 sq. metre, about $10\frac{3}{4}$ sq. ft. Hinträger gives from that to 14 ft.

Mr Edward Shaw, in his book on School Hygiene, speaking of America, protests very strongly against the plan of allowing less space per head in Primary Schools than in the Higher Grade Schools, pointing out that the additional space gained by the smaller desks which are required is especially needed to allow of opportunity to carry on the different exercises and activities which are so essential a part in primary teaching. The additional floor space allows, he urges, provision for the extra motor activities of primary pupils, who should not spend more than one-third of their time at school actually in their seats. For this purpose he suggests keeping the size of the room which would be required for 48 older pupils, limiting the number to 40, and arranging the desks rather to one side of the room. This plan of allow-



17. Dual Desk with Hinged Top.



18. Long Desk with Separate Seats.

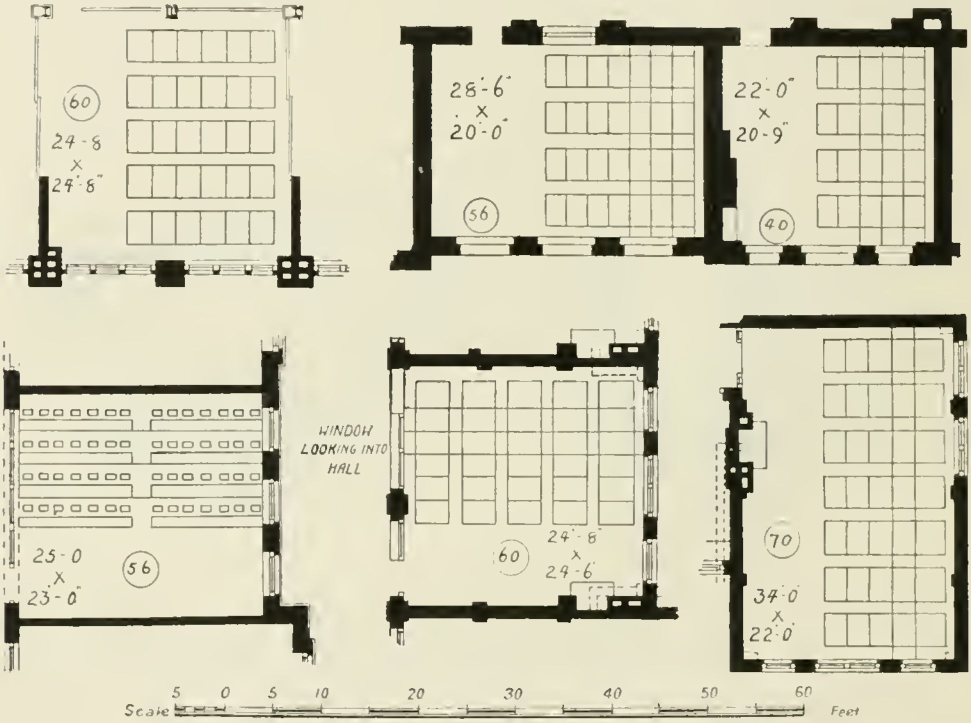
ing, as it were, space for play or drill in each class-room makes a great demand on space. It would seem that, given a well-planned school, with the class-rooms arranged round a large school-room or hall, the advantages of movement and exercise could be gained without so great a sacrifice of space.

The arrangement of desks usually adopted in this country is that of the double desk. These are always found in the schools of the London School Board and most of the Provincial Boards. They are almost universal in Germany, and are no doubt the most satisfactory form of seat where sufficient space cannot be allowed for the single desk.

These desks are made in considerable variety, with various arrangements, more or less successful, for altering the slope of the desk, or raising a flap to act either as a reading-desk or to facilitate standing up (see Fig. 17).

There is a form of desk which has some advantage in economising space, and that is a long desk to take nine or ten or more scholars, but with a separate seat to each scholar instead of a bench. This ensures that there should be no crowding, and that no more pupils than the room is designed for should be put in, while at the same time providing for the easy ingress and egress of any particular one, the teachers being able to walk along the back (see Fig. 18). For this purpose not less than 18 in. per pupil should be allowed in breadth.

The dimensions of the double desk for Elementary Schools above the Infant Department, according to the regulations of the Board of



19. Six Class-rooms from Elementary Schools.

Education, should not be less than 3 ft. 4 in. to give sufficient room for writing. The depth will be from 2 ft. 3 in. to 2 ft. 6 in.

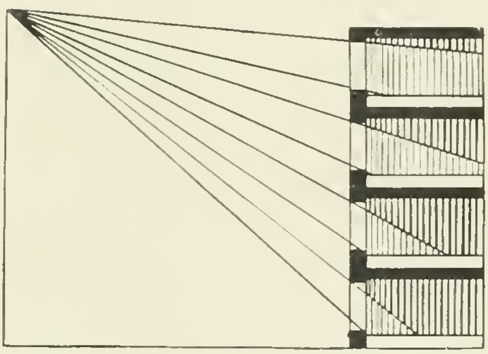
It is customary in Elementary Schools to raise the back rows slightly, the last three or four rows being placed on steps 4 or 5 in. In Fig. 19 are given a number of class-rooms taken from recently erected Board Schools in London and the large provincial towns, which will show the various plans of arranging the seats for different numbers.

Desks are still used in a number of schools which are capable

of taking four or five pupils. They are as a rule made with a flap to turn up for the purpose of allowing easy ingress and egress, and also to make a reading-desk. In a desk of this length, the flap being of considerable length is very heavy, and it is as well for the teacher to be prepared to deal promptly with crushed fingers or bruises, since a boy at one end may turn down the desk unperceived by those at the other.

THE LIGHTING OF CLASS-ROOMS.

As mentioned above, too much care cannot be exercised in the proper size and position of windows. Provided that there is no actual glare in the eyes of the pupils or teacher, it is hardly possible that a room can be too well lit. The question as to whether a room is sufficiently lit or not is one very difficult to decide, for a class-room may on entering appear bright and well lit, and, as far as the general illumination is considered, may be so; but when a more careful examination is made in different parts of the room, it will often be found that the light on a certain number of the desks is below what should be considered the minimum allowance.



20. Showing Effect of opposite Houses on Light.

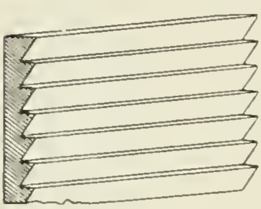
Another point which cannot be too strongly borne in mind is that the amount of glass space to be allowed should be calculated for the dark and overcast days. Many class-rooms admirably lit in fine bright weather do not provide nearly enough window space for the dull days of winter. As Javal* says, "The class-room should be flooded with light, so that on dark days the corner of the room farthest from the windows shall have sufficient light." There is little danger of having too much light; adjustable blinds will meet the rare occasions when the light is too strong and dazzling. From an experiment† made in America, it appears that the light in a room into which the sun is not shining directly will be three times as strong when the sun is out as when the sun is obscured by a passing cloud.

The question of the best aspect for class-rooms has been already discussed when dealing with the position of school buildings. As most

* Hygiène des Auges, 1880. † School Hygiene, Shaw, 1901.

of the work in a school is done in the morning, the conclusion come to was that the best light will be obtained from the south-east and south. Even on dull cloudy days the light from that direction is considerably stronger than that from the north. Wien found that on a dull cloudy day test type which could not be read at a distance of 4 or 5 ft. in a class-room facing north was clearly legible in one facing south, the windows in both cases being the same size, and the school building standing clear of houses and trees.

The most important factor in regard to lighting after that of aspect is that of the surroundings of the school building. This of course refers chiefly to schools built in towns, and at any place where there are houses sufficiently near to intercept some of the light on one or more sides. Where there are high buildings opposite the school, some portion of the class-rooms, *i.e.*, the part farthest from the windows facing that way, will be insufficiently lit, this proportion of badly-lit space decreasing of course in each story upwards (see Fig. 20). In the case of a street, it is sometimes reckoned that the minimum distance to be allowed is, that the breadth of the street, *i.e.*, the clear space between the two opposite houses, should at least be equal to the height of the houses; but even with this allowance it is only the seats close to the windows that get sufficient light, and on the ground floor at least half the room is too dark (see Fig. 20), being lit chiefly by reflected light from the walls opposite;* and as the school should be at least a sufficient distance from the opposite houses to enable every pupil to be able to see at least some part of the sky, the distance between the school and the house opposite should not be less than twice the height of that building. In the regulations for school buildings in Berlin it is laid down that there should be no building nearer to the school than 60 ft.



21. PRISMATIC GLASS.

The usual custom with regard to questions of interference with light by buildings opposite is to draw a line at an angle of 45° from the window of one building. If this clears the other building it is considered that the light is not interfered with. In "School Hygiene" Mr Shaw states that an angle of not more than 60° is required to fully satisfy the requirements of light and air.

In cases of existing schools where the rooms are insufficiently lit

* Houses with plain brick fronts are reckoned to absorb from 70 to 90 per cent. of the light in reflecting.

owing to houses or buildings standing too near, the illumination of the room can be very greatly increased by the use of ribbed or prismatic glass—that is, glass made in the form of a series of prisms (see Fig. 21), by means of which the rays of light are caught and thrown horizontally into the room, instead of merely falling on the floor close to the window. It is of course necessary that the glass prisms should be so adjusted that the angle at which the light is deflected inwards by the prism should be arranged to give the best results with the angle at which the light falls upon it from the outside, the angle naturally varying with each floor. The glass is made so that it can be used with ordinary sash windows, that known as the Luxfer prism being perhaps the most successful.

In some tests made in 1900 at the Massachusetts Institute of Technology * it was found that the best results were given by factory ribbed glass, plain on one side and having twenty-one ribs to the inch in true curves, concave and convex. This, with a sky angle of 60° or less, increased the effective lighting by 50 per cent. The glass is of course set with the ribs running horizontally, unless it is fixed in a position where it is required to catch the light from an opening between two high buildings, when it is set vertically. Where a school has to be placed or is already in position in a street too narrow for the effective lighting of the rooms on the lower floors, it should if possible be arranged that only the upper floors should be used for class-rooms, reserving the lower for any purposes for which light is not so important. Cohn † speaks very strongly against the evils attending a school built in a narrow street, saying finally that the short sight in a school increases so exactly in proportion to the narrowness of the street, that if he were given the number of scholars in the school suffering from myopia he would undertake to deduce the width of the street in which the school lay.

Skylights are a most unsatisfactory method of lighting, and should be avoided. Sometimes, however, in the case of an old building they can be used, but should only be regarded as the lesser of two evils, want of light, unless very bad, being worse than the discomfort of cold draughts and hot sun caused by the skylight. When used they should only be placed on the northern slope of the roof.

Size and Position of Windows.—The size of the windows is usually settled by the proportion of clear glass space that should

* School Hygiene, E. Shaw, 1901. † Lehrbuch der Hygiene des Auges, 1892.

be supplied in proportion to the floor space, and this is estimated at various amounts by different authorities, but all will be found to lie between the proportion of one-fourth to one-sixth of glass space to floor space. The following list will show the different amounts demanded by various writers on the subject :—

Robson, School Architecture - - -	1 to 5.
Briggs, Modern American School Buildings -	1 „ 6.
Shaw, School Hygiene - -	1 to 4 or 6 (according to aspect).
A. Dukes, Health at School - - -	1 to 4.
Erismann - - - - - -	1 „ 5.
Cohn - - - - - -	1 „ 5.

In a list of schools given by Baginsky * the proportion varies from 1 to 4 to 1 to 6, but the average would come to about 1 to 5. So that while perhaps in an open situation on the south side the proportion of 1 to 6 would be sufficient, in a place where the light had not perfectly free access, or for rooms looking north, the proportion of 1 to 4 would not be too much to ensure proper lighting during dull weather.

The amount of window surface to be supplied is sometimes given in so many square inches per head for the pupils the room is to accommodate. Cohn gives 2,052 q.c.m. (about 2 sq. ft.) as a sufficient allowance, while Erismann raises this to 2,670 q.c.m. ($2\frac{1}{2}$ sq. ft.); but this does not seem an altogether satisfactory method of reckoning, as, in the case of a larger amount of floor space than usual being allowed, the window space provided would not be increased in proportion.

According to Mr Shaw, the illumination in the darkest part of the room should not fall below 50 candle metres, a candle metre being the amount of light given by a standard candle at 1 metre's distance. This, the writer observes, is rather more than that given by Cohn. In order to ensure this amount on dull sorts of days and weather, rooms having a southern exposure should have not less than one-fourth of the floor space transparent glass. In rooms with a northern aspect it should be somewhat greater. In this country a proportion of 1 to 4 is not too much, when the number of dull and cloudy days are considered.

But to ensure the efficient lighting of the desks it is by no means enough to merely supply the requisite amount of glass space. The positions of the windows themselves have a great influence upon complete lighting of the rooms. As to the direction from which light should enter, all authorities are unanimously agreed that class-rooms should be lit from the left side, in order that the scholars should not be

* Schulhygiene, 1898.

writing in the shadow of their hand. Light coming from the wall behind the master's desk should under no circumstances be allowed, for not only does the glare of the light directly in the face of the pupils cause great discomfort and injury, but they are also unable to see the master's face or the blackboard clearly. As to the admission of light from the back of the room, there is some diversity of opinion, but, provided that the light admitted by such windows is neither so much nor so strong as that admitted from the side windows, *i.e.*, so that it is not strong enough to cast shadows, then as far as the pupils are concerned such light may be allowed without harm, and will add to the general illumination of the room, without causing any inconvenience. However, the teacher who has to face these windows will probably find a certain amount of discomfort, and be apt to find his eyes weakened or injured.

Of course windows placed at the back only would be extremely injurious both to pupils and teacher. In France windows opposite the teacher are not allowed, and are seldom found in Germany.

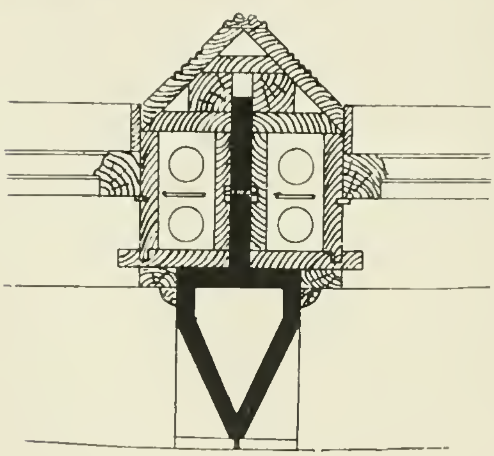
Additional lighting may be obtained, if necessary, from the right-hand side, but care must again be taken to ensure that light brought in from that side is not strong enough to overpower that from the left, and so cause shadows. The windows should be high up and not too large. On the whole, there is little question that the best way to light a class-room is to have all the windows on the left side of the room, with a small supplementary window fairly high up on the right side or at the back of the room, and more for the purpose of ventilation to obtain a through draught than for that of light, except in the case of an unusually wide room, when it is usually necessary to get some light from the back (see Fig. 11).

In his book on School Hygiene, Mr Shaw mentions a suggestion made by Javal, and supported by Cohn, that the school-room should be lighted from above, saying that it is to be approved theoretically, but that it would not be feasible from the practical point of view. It is difficult to reconcile this with his objections made further on to the use of high sills, that, by preventing the children from looking out, they invest the school-room with an irksome air of confinement. A school-room lit from the top only would be a gloomy place indeed, though in the one-story school buildings, of which there are now a certain number, it would not be difficult to carry out, but the down draught of cold air would seriously add to the difficulty of warming and heating.

In placing the windows it is of great importance, firstly, that there should not be a large space of wall between the back of the room

and the first window; and secondly, that there should not be wide piers between the windows. It is not at all uncommon to find class-rooms with only two windows; this necessitates, except in very small rooms, a considerable width of wall between them, and however well the room may be lit as a whole, there will be a heavy shadow cast across the room where the pier comes. It is hardly possible to construct brick piers of sufficient strength in a building of any height that will not interfere considerably with the light. In order to meet this objection, Mr R. Briggs, an American architect, has tried with success a plan of using iron mullions cast with heavy flanges or webs, with the window frames bolted directly to them (see Fig. 22). In this way it is possible to put the windows sufficiently close, and at the same time provide sufficient strength. Where brick piers are used, a considerable gain in light is obtained by bevelling off the piers.

The height of the windows naturally depends on the height of the room, but they should always be carried up as near the ceiling of the room as constructional necessities will admit of, both for the sake of ventilation as well as that of light.



22. Iron Mullion.

Dr Baginsky calculates that, in order to allow of the row of desks farthest from the window being properly lit, the depth of the room should be two and a half times the height of the window above the level of the top of the desks. That is to say, in a room 23 ft. wide the height of the window should be 8 ft. 10 in. high, supposing there to be a gangway of about 3 ft., which must be subtracted from the width. In Saxony it is required that the height of the window space above the level of the desk should be two-fifths of the depth of the room.

Height of Sills.—The height of the window sill plays an important part in the question of lighting. In the first place, it should not be below the level of the top of the desks, or there are likely to be unpleasant reflections from the floor; nor, on the other hand, should it be so high that the children are unable to see out. There is a dreary

appearance given to a room where the window sills are too high. There is also an unnecessary loss of lighting area. Mr Robson * recommended that the sills should be at least 5 ft. from the floor and more with advantage. His object in making this suggestion is to enable the heads of the window to be brought as near the ceiling as possible, but it does not seem necessary for this purpose to raise the sills to such a height, for, unless the room is unduly high, they can be carried to the ceiling in any case. In looking at a class-room where the sills are high it will be noticed that the row of desks next the windows are completely in the shadow cast by the window sill. This can to a certain extent be obviated by sloping the sill downwards. In Germany the window sills are as a rule between 3 and 4 ft. from the floor. In some recently erected schools in Berlin the window sills are just under 4 ft. In his book on School Hygiene, Dr Baginsky comes to the conclusion that 3 ft. 3½ in. should be regarded as a minimum height.

The building regulations of the Board of Education in this country give 4 ft. as the height of the sills.

In America the usual height is from 3 ft. 6 in. to 4 ft. Mr Shaw gives 3 ft. 6 in. as the best height.

In some recently erected Secondary Schools in this country the height lies between 3 ft. 6 in. and 3 ft. 9 in. It may, I think, be concluded that 3 ft. 4 in. to 3 ft. 6 in. is a good height. It is sometimes recommended that where the windows are low enough to allow the pupils to look out some precautions should be taken, such as fluted glass for the lower panes, or whiting, to prevent their attention being distracted from their work. This is unpleasant in appearance, and should surely be unnecessary. The lesson must be badly given if it cannot supply a sufficient counter-attraction.

Erismann gives the measurements taken from those of his model class-room as 3 ft. to the window sill, 10 ft. 6 in. for the window opening, and 1 ft. 7¾ in. above the top of the window. This last measurement is too large, as by means of care in construction and the use of girders the head of the window can be brought very much closer to the ceiling. In the Sekundarschule recently erected at Zurich the glass is carried right up to the ceiling. The foregoing remarks on lighting may be shortly stated as follows :—

1. The main light to be from the left, other windows being only supplementary or for the purpose of ventilation.

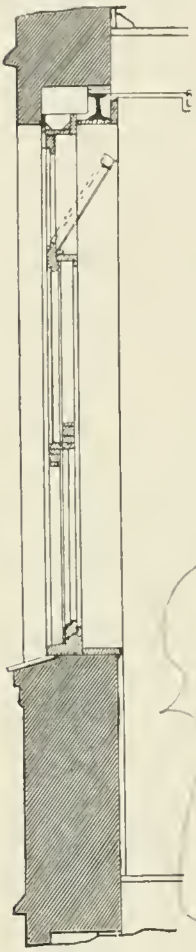
2. That the transparent glass surface in a class-room should be

* School Architecture, 1877.

if possible one-fourth of the floor space, and should never, even on the south side, be less than one-sixth.

3. That the sills of the windows should be not more than 3 ft. 6 in. from the floor, and if higher should be bevelled off.

4. That the glass should be carried as near the ceiling as may be constructionally possible.



23. A Class-room Window.

5. That the piers between the windows should be narrow, and splayed or bevelled off.

6. That the window at the end of the room opposite the master's desk be as near the back wall as possible, and in any case the distance between the back wall and the window being at least as small as the gangway behind the last row of seats.

The windows themselves should be constructed so as to allow the fullest amount of transparent glass surface. No transoms or heavy mullions should be allowed, because these are apt to cast shadows or make the lighting uneven, even though there may be a sufficient surface of glass after deducting these. It is hardly necessary to add that in calculating the glass surface it is not the window openings that are meant, but actual glass surface.

The form of window that is best adapted to school use is a well-made, easy-working sash window. It is an excellent plan to make the top part of the window open in the form of hoppers for the purpose of ventilation (see Fig. 23). For a window on this principle, which has been tried in a large number of schools and is found to work well, it should be remembered that in order to avoid down draughts it is essential to have cheeks to these hoppers. Any class-room looking to the south or west should be provided with blinds. It is an excellent plan to make these rolling upwards from the bottom, so that the window can be obscured easily up to any desired height. The glass should be as near the outside wall as any building regulations there may be will allow, both to gain light and also to keep the glass farther from the pupils sitting near the windows.

The colour of the walls has of course a great influence on the lighting of a room, for while it is obviously necessary not to put a colour which absorbs too much light, on the other hand too white a

wall produces unpleasant glaring effects and is painful to the eyes, so that in selecting a colour it is necessary to select one that, while being restful to the eyes, shall not absorb too much light. Light yellow and buff are colours often used and often recommended, but investigations point to the fact that yellows produce fatigue and nervousness to a marked degree as compared with other colours. Some shade of green seems on the whole the most satisfactory colour to use. It is restful to the eye, does not absorb light to anything like the extent of the reds and browns, and there is more resemblance in light reflected from a green surface to actual light out of doors, where at the time of year that light is strongest there is most green to be found.

German writers recommend a green or greyish green as most suitable. A light greenish grey which can be made with Antwerp blue, raw sienna, and white, will give a most pleasant result. The walls should always be painted so as to allow of washing, but the paint should be flatted in order that there should be no gloss or shine.

The ceiling should of course be left white in order that as much light as possible may be reflected from it. It should be kept flat. Any raised beam or girder has a powerful action in stopping the movement of the air, and so hindering ventilation. It is customary in Elementary Schools to paint the points of the compass upon the ceiling.

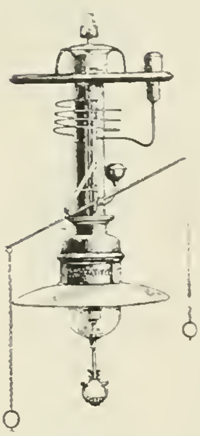
ARTIFICIAL LIGHTING OF CLASS-ROOMS.

In schools where work is carried on in the afternoon or evening, or in schools situated in large towns liable to fog, the question of artificial lighting assumes considerable importance. The requirements necessary to produce satisfactory results are obvious enough—sufficient illumination, steadiness of light, and as little vitiation of the air as possible. Any colour in the light, such for example as a strong yellow, tends to lessen the contrast between the black and white of printing or writing, and so is apt to lead to visual fatigue.

Petroleum Lamps.—For schools in country places where there is no supply of gas obtainable, which are of insufficient size for the generation of their own gas or electric light, some form of petroleum lamp must be used. The recent improvement in the methods of making and using acetylene gas, which can be installed at a comparatively small cost, offers an alternative, and the methods and apparatus are described below when dealing with gas.

The usual form of hanging lamps for petroleum found in country schools are an unsatisfactory means of lighting, but as such schools are

as a rule only used during the hours of daylight, it is usually when the room has to serve for parish meetings, &c., that the light is wanted.



24. A Petroleum Regenerative Lamp.

One of the strongest objections to hanging lamps lies in the shadow cast by the body of the lamp itself. There is a method of using petroleum for illumination in which not only is this difficulty got over, but by which a very brilliant light can be obtained. A lamp of this kind is illustrated in Fig. 24. They are known as "regenerative" petroleum lamps, and are much on the same lines as the regenerative gas burners described later. The heat of the lamp is used to raise the temperature of the incoming air, and to volatilise the oil. By this means a very intense light is produced, which has the further advantage that the strongest light is thrown downwards. Lately a petroleum lamp, which also burns the volatilised oil, has been invented, which is fitted with an incandescent mantle (see Fig. 25). It has hardly had sufficient trial yet to warrant its adoption in schools, though good results are claimed for it.

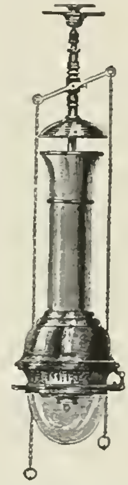
25. Petroleum Lamp with Incandescent Mantle, made by the Welsbach Company.

Gas.—Gas is of course by far the most extensive method of lighting at present in use, but as ordinarily installed, with flaring jets, is by no means a satisfactory form of illuminant. The light is yellow and unsteady, and, when the pressure is high and the combustion imperfect, produces a very high percentage of noxious fumes. In order to provide against the constantly fluctuating pressure, there are various kinds of governors in use placed on the house side of the consumer's metre, or some kind of governor actually in the burner itself, or both are supplied. In cases where regularity of pressure is essential, such as the Welsbach incandescent lamps, it is better to have the governors at each light only. The principle upon which they are usually arranged is somewhat as follows:—There is a small chamber through which the gas flows, the inlet being partially closed by a small cone, which rises automatically and reduces the size of the inlet or fissure as the pressure increases, sinking again as the pressure grows less. Sometimes the governor is arranged with a flexible leather diaphragm, which, expanding upwards

26. A Governor for Gas.

under pressure, draws up a spindle which regulates the size of the opening. Fig. 26 shows an example of a governor burner, in which the float in the centre is kept in position by means of a thin metal needle running up through it. Of course there are many varieties of governors, and, as long as they are fairly free from dust and dirt, work fairly well, but all require an occasional inspection. When the float has merely stuck, tapping the burner smartly will often remedy matters, or, if necessary, unscrewing the base of the burner and setting it free.

The Argand burners, though formerly in considerable demand, do not meet with much approval at the present day, the necessity of having a chimney to each light and the heat evolved militating seriously against their use. The principle upon which the Argand burner is based is as follows:—The burner consists of a hollow steatite ring pierced all round with a number of small holes through which the gas passes, being brought to the chamber under these holes by three small metal tubes. Air is allowed to come in through the centre of the circular flame as well as upon its outer surface. These lamps are very sensitive to variations in the pressure of gas, and should always be fitted with a governor. The light given is rather better for the amount of gas used than that of the ordinary flat-flame burner.



27. Siemens Regenerative Gas Lamp.

By increasing the temperature of the illuminating flame, the intensity of the light emitted is raised proportionately. Upon this principle is based the idea of what are called regenerative burners. The heat of the lamp itself is utilised to raise the temperature of the air before it is allowed to come in contact with the flame. "It is found that the light emitted from high-class burners of this description, such as those of Wenham or Siemens, is about three times greater per unit of gas consumed than that emitted from ordinary Argand or flat flames." *

The Siemens lamp (Fig. 27) is a very powerful form of illuminant, and it can be placed high up, as it throws most of its light downwards. Further, not only can it easily be made to carry off its fumes, but can materially assist in carrying off the vitiated air from the top of the room. It is a very excellent and satisfactory method of lighting large rooms or halls, and is used in Germany to a considerable extent in class-rooms.

* *The Builder*, 14th September 1901.

Albo-Carbon Lamps.—Albo-carbon or recrystallised naphthaline is used for intensifying the light obtainable by ordinary gas. The albo-carbon is placed in a reservoir through which the gas passes to the burner or burners, the heat of which is used, by means usually of a copper conducting rod, to melt the albo-carbon. At a temperature considerably below that of boiling water, the naphthaline vapour is given off, and, mixing with the gas, greatly increases its illuminating power. It is, however, rather apt to smoke, and requires a certain amount of attention in refilling the reservoir periodically, and, while giving a strong light with an economical use of gas, it does not compare favourably with the incandescent gaslight, which has to a large extent superseded it.

Incandescent Gaslight.—Though of course all light is obtained by incandescence of small particles, the word, where used in reference to gas, is generally held to mean the heating by a non-luminous flame certain substances to a state of brilliant incandescence. The practical use of this principle is due to Dr Auer von Welsbach, who in 1885 succeeded in making a commercially successful adaptation of this principle in the form of the well-known Welsbach burner. This form of lamp has been brought to a considerable pitch of perfection now, and, while giving a very powerful light, is very economical in the amount of gas used, it having been found that somewhere between five and six times the amount of gas is required to obtain the same amount of light in an ordinary flat-flame burner that is necessary for an incandescent gas lamp. A further advantage lies in the fact that, owing to the high temperature in the lamp, the combustion is more complete, and so less vitiation of the air is caused. But, in spite of the many undoubted advantages of this light, it is not altogether adapted for school purposes as far as lighting class-rooms is concerned. Trouble is caused by the somewhat fragile nature of the mantles, which are peculiarly liable to damage in a school, owing to the vibration of the floor caused by the movements of large numbers, or to the strong draughts when windows are opened to get through ventilation. There is an arrangement to provide against damage by jar or shocks known as the "anti-vibration" holder (see Fig. 28), which claims to obviate any danger of breaking the mantles by jar; but while it may effect this it unfortunately increases another drawback, which lies in the shadow thrown by these lamps on any desk immediately underneath. Where these lamps are in use, it should be remembered that the dimness which at times comes over these lamps is usually due to dust falling on

28. Anti-vibration Holder for a Welsbach Lamp.

the wire gauze through which the gas comes. This can be easily cured by lifting off the burner and blowing through it, care being taken not to injure the mantle. The lamps supplied with small by-pass burners save a lot of trouble, and generally ensure a longer life to the mantle. They are, however, sometimes disapproved, on the ground of their tendency to blacken the mantle, and their liability to extinguishment by draught.

The inverted gas mantle obviates the disadvantages of the shadow thrown by lamp holder, while giving a powerful and excellent light.

Acetylene.—A method of illumination that has come into considerable use in the last few years is that of acetylene, and in country places and small villages, where there is no public supply of gas or electric light, is sometimes found of great use.

Pure acetylene gas is a colourless and nearly odourless gas, but the ordinary commercial form has a strong and rather unpleasant smell, which has the advantage of ensuring a fairly prompt detection of leakage.

The gas, which is produced for the purpose of lighting by the addition of water to calcium carbide in a solid condition, is in a pure state not a particularly dangerous gas, but when mixed with ordinary atmospheric air makes a highly explosive compound. But given reasonable care and a properly arranged generating apparatus, there is little more risk in its use than in that of ordinary coal gas. In illuminating power the superiority of this gas is very marked. It gives a brilliant white light of great intensity and of high actinic power, the flame required in order to give the same amount of light being relatively much smaller than that of an ordinary flat gas flame. The illumination given by burning 1 cub. ft. of acetylene per hour is given as 32 candles, gas giving in an ordinary flat flame only $2\frac{1}{2}$ candles. In regard to vitiating effects on the air in the room, this light compares very favourably with other forms of illuminants, as the following table, drawn up by Professor Lewes, shows:—

Comparative Hygienic Effect of Illuminants per Unit of Light.

	Carbonic Acid Evolved.	Moisture Evolved.	Oxygen Removed from Air.	Heat Produced.
Acetylene	100	100	100	100
Coal gas, flat flame	480	1,470	520	795
Coal gas, mantle	45	230	62	87
Petroleum, large lamp	995	700	498	246

The calcium carbide from which the gas is generated is produced by the combination of lime and carbon under the influence of great heat generally in some form of electric arc furnace. There are many different forms of generators for the purpose of decomposing the carbide by means of water; either by dropping the solid into water, by allowing the water to rise to it, or by allowing water to drop upon the carbide. The important point to be guarded against is the rise in temperature that occurs during the generation of the gas. For this reason the forms of generator which allow water to drip or be sprayed over the carbide are to be avoided. Where the carbide is dropped into a considerable quantity of water cool generation can be ensured, but owing to the solubility of acetylene in water there is a certain amount of gas lost. The carbide is usually soaked in petroleum before use in order to retard the action of the water and prevent too rapid a formation of gas. In any case the best results are only to be ensured by having a careful and intelligent man to take charge of the apparatus. The additional cost incurred by having an apparatus for cooling and purifying the gas, as well as a small gasometer so that the gas can be always ready, is repaid by the improvement in the working of the light.

It is generally reckoned that the cost of the installation and supply of acetylene is about equal to that of gas when the price of that is about 3s. 6d. per 1,000 ft., but probably this is too low, and in an article in *The Builder* the writer maintains that it is not advisable to put in an installation of acetylene, at any rate for domestic lighting, where gas is procurable at a cost of under 5s. per 1,000 ft.* The initial cost of installation is not great including all the generating apparatus, probably about 15s. to 20s. per light for an installation of not less than 100 lights. This light has been successfully tried in a few schools.

Electric Light.—The incandescent electric light has so many advantages in its immunity from danger of fire, absence of heating, or vitiating effects, and in steadiness of light, ease of control and freedom from dirt, that it is being almost universally adopted wherever possible for every sort of building. In spite, however, of its many advantages, it is exceedingly difficult to arrange it so that there will be a really efficient light for working, and in lighting a class-room considerable care is necessary in the arrangement if a satisfactory result is to be obtained. It is sometimes objected against it that the light is rather inclined to be yellow, and that the glowing filament throws a kind of

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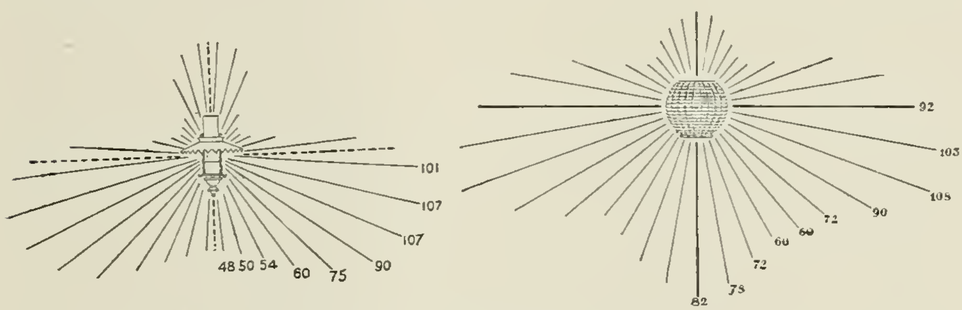
* *The Builder*, December 1901.

line on the book immediately under it. The flattened globular lamps with the upper parts silvered are particularly bad, as they throw a shadow of the filament in a peculiarly unpleasant way. The use of ground glass globes takes off about 50 per cent. of the light.

Speaking generally, most of the complaints and dissatisfaction arising from the use of electric light are due to an insufficient supply of lamps, or to the use of lamps of too low a candle-power. Incandescent lamps have the peculiar property of making a room seem thoroughly bright and well lit, until it becomes necessary to read or write. The discomfort then felt is usually attributed to the quality or kind of light, when really due merely to the want of more powerful lamps. This is to a large extent due to the fact that an electric lamp, while appearing bright, does not seem to have a great power of diffusion. In arranging the lights for a class-room it cannot be too strongly borne in mind that



29 Diagram showing the Direction of Strongest Light with a Plain Lamp and a Holophane Globe.

there should be a most liberal supply of lamps, and those of fair candle-power, and not hung too high up.

Shades and Globes.—Shades are used either for the sake of producing a greater diffusion of the light, or to prevent the irritation caused by a naked flame if of any great degree of intensity. Of course any shade must obstruct some proportion of the light, but, as they may be arranged to direct rays downwards which would otherwise be wasted or to cause greater diffusion, the actual result may be a better illumination where required than is given by the open flame. With ordinary gas burners, a ground glass globe stops from 18 to 23 per cent. of the light in a horizontal direction, the proportion of light obstructed growing less as the intensity of the light is increased. In the case of class-rooms, the lighting is of course always from overhead. In the case of open flames, the direction of the strongest light is horizontal, and with ordinary flat-

flame burners the light in a downward direction is at a certain elevation, and within a certain radius increased by a globe shade, clear glass increasing it 6 per cent., ground glass about 9 per cent., while albatrine and opal globes will increase it as much as 20 per cent. by reflecting light downwards. The globes should always have a wide opening at the bottom. The narrow-necked globes induce a draught which causes a good deal of flickering.

Another form of globe which has recently come into use is the Holophane globe. Great powers are claimed for this invention in the direction of improved diffusion of the light, Mr Edward Shaw, in his work on School Hygiene, speaking very highly of it. The globe is made usually of clear glass. On the outside are horizontal prismatic lines, while on the inside the prisms run vertically. The outside horizontal prisms direct the light downwards, while the vertical prisms inside spread the light evenly over the shade. In this way the effectiveness of the light is very largely increased in the direction where it is most valuable, *i.e.*, below the horizontal. The diagram (Fig. 29) shows the relative proportions of light in different directions between an ordinary flat burner with naked flame and one with a Holophane globe. These globes can be used with any kind of light, and give excellent results with a Welsbach burner. The light on the desks in a room can of course be very largely increased by the use of reflectors. They should preferably be made of thin porcelain or opal, which will increase the downward light by as much as 60 per cent., and should be made with as flat an angle as possible. Metal or mirror reflectors, of course, are far more effective, but could hardly be used in a room owing to the glare.

Amount of Light required and Position of Lamps.—It is not very easy to say what constitutes efficient illumination, and there is perhaps nothing more difficult to judge of by mere inspection. There are, however, various instruments for the purpose of measuring light known as photometers, the amount measured being usually expressed in terms of so many candle-power for the convenience of comparison, the various forms of illumination being reduced to this standard.* The proper diffusion of the light, again, has an important bearing upon the amount necessary. Where the light is derived from one point, or where there are bright points that catch the eye, the

* The standard for this purpose is the light emitted by a spermaceti candle of known composition, burning at the rate of 120 grains an hour.

value of the light for the purposes of work will seem actually less than in a room where the light, though not so strong, is well diffused. This is due to the involuntary contraction of the pupils, caused by looking at a bright point, which reduces the amount of light entering the eye. For this reason a frosted electric lamp will, under certain conditions, seem to give a better light than one of the same candle-power with clear glass.* As far as possible, unprotected lights should not be tolerated in a class-room. Where the lighting is well diffused and well placed, there will be an absence of strong shadows.†

It should not be forgotten, in estimating the amount of candle-power required, that the strongest light is usually found in a horizontal direction from its source, so that, while a sufficient candle-power is supplied to make the room thoroughly light, the illumination in parts where the light is actually required may be far below the requisite amount.

The amount of lighting necessary is again, to a large extent, dependent upon the colour and the surface of the walls. The following table, giving some of the results of investigations made by Dr Sumpner, will show the great variation in different colours :—

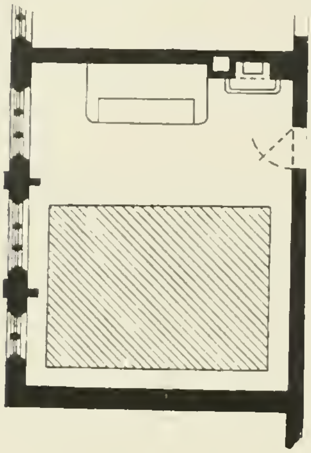
Yellow wall paper	reflects	40	per cent.	of the light	falling	on it.
Blue „	„	25	„	„	„	„
Dark brown wall paper	„	13	„	„	„	„
Deep chocolate „	„	4	„	„	„	„
Plain deal (clean)	„	40 to 50	„	„	„	„
Plain deal (dirty)	„	20	„	„	„	„
Yellow painted wall (clean)	„	40	„	„	„	„
Yellow painted wall (dirty)	„	20	„	„	„	„

In arranging the position of the lights, whether electric light or gas, the arrangement of the desks should be first determined. When, as is commonly done, the fitter is instructed to fix a certain number of points, he is apt to dispose them symmetrically over the ceiling, with the result in many cases that much of the light is wasted. For example in Fig. 30, taken from an actual building, there would be a large amount of light wasted in lighting the unoccupied space in front

* Frosted glass is usually reckoned to stop from 30 to 50 per cent. of the light.

† Mr Fleming, in "Electric Lamps and Electric Lighting," suggests a rough test of the distribution of the lights :—Take a white card or sheet of writing paper, hold it horizontally about the level of the eye, then hold a pencil or other small rod vertically on the card ; it can then be easily seen if there is a strong shadow in any direction.

of the desks. In Germany great care is usually taken to concentrate the light over the desks, and to make it come from the left to correspond with the light during the day. A special light arranged to light the blackboard will be found an advantage.



30. SHOWING THE DISPOSITION OF SEATS IN A CLASS-ROOM. From an actual Building.

Number of Points and Amount of Candle-Power required for Gas.—As class-rooms do not vary to any great extent in height, it is a convenient method of reckoning to consider how much candle-power is required for a certain area of floor space. In some figures published for various classes of buildings by Messrs Stott, 300 candle-power for 1,000 square feet of floor space is suggested for schools. This is almost the same amount as that demanded by Mr Grafton,* who remarks that for class-rooms not much over 12 ft. high a useful rule is to provide one candle-power to every 3 sq. ft. of floor space, the lights being placed about 8 ft. from the floor. This, provided that the walls are not dark, will provide an excellent illumination, somewhat in excess of that usually found. This means that in a class-room, measuring say 30 by 20 ft., twelve of the ordinary fish-tail burners would be required, or four Welsbach incandescent lamps. A form of double incandescent lamp that has been found very satisfactory for school work is shown in Fig. 31. It should have an opaque white guard as well as the reflector, to shield the light from the eyes of the pupils.

31. A DOUBLE WELSBACH LAMP.

The following table, quoted in a series of interesting articles on gas lighting that appeared in *The Builder* during 1901, gives the results of some experiments made by Major Scott-Moncrieff on the lighting of barracks. The room in which the experiments were made was 40 ft. long and 20 ft. wide. The lights were placed at 8 ft. from the floor, and the illumination was judged by means of photometers, at a height of 2 ft. from the floor, so that the results would give a fair suggestion for a class-room of a similar size. The top of a desk would be of course a little higher.

* A Handbook of Practical Gasfitting, Batsford, 1901.

ILLUMINATION OF A BARRACK-ROOM, 40 FT. BY 20 FT., AT A HEIGHT OF 2 FT. ABOVE THE FLOOR.

Description of Burner.	Total Gas Consumption per Hour.	Illumination.
	Cub. ft.	
Two Bray burners - -	16	Whole room insufficiently lighted, nowhere possible to read small print 6 ft. below gas lamp.
Two flat-flame burners fitted with caps - - - -	11.4	About one-quarter the working space illuminated.
Two Stott-Thorpe reflex lights	18	Eight-tenths of working level efficiently lighted.
Two Sugg's workshop lights -	16	About one-quarter the working space efficiently lighted.
Siemens regenerative - -	11	Whole room well illuminated.
Diemel regenerative - -	9	Two-thirds working space efficiently lighted.
Two Schulke lamps - -	10	Practically whole working space illuminated.
Welsbach incandescent, with glazed conical reflector -	4.3	Whole room brilliantly lighted.

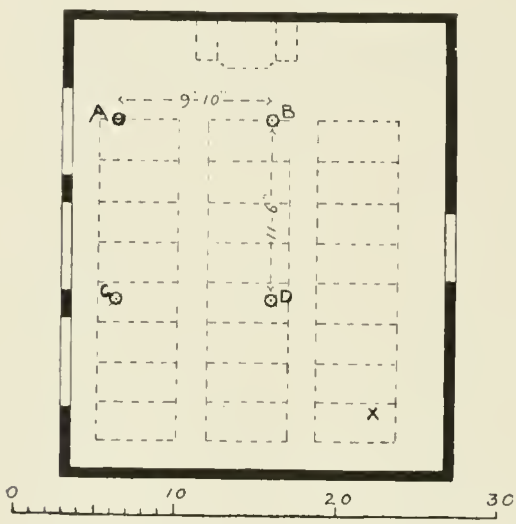
The results of this are strongly in favour of the incandescent gas lamps and the Siemens regenerative lamps. The former light has been discussed in this connection before, and the disadvantages pointed out, but, provided proper care is taken with shades and reflectors, these can be sufficiently overcome for practical purposes. The Siemens regenerative lamp is admirably adapted for lighting large rooms, gymnasia, and halls. It can combine with the light considerable ventilating power, as has been already pointed out. The initial cost is, however, rather high, and it requires cleaning occasionally. In Germany it is used to a considerable extent for class-room lighting, great care being taken in the exact position of the lamps, so that the light shall approximate as closely as possible to that of daylight, and come from the left of the pupils.

The diagram (Fig. 32*) on page 100 shows a suggested method of lighting a class-room with this form of lamp. The room measures 29 ft. 6 in., and is intended to accommodate 48 scholars. The distance from the teacher's desk to the front row of seats is about 6 ft. 6 in. The lighting would be provided by means of four of these lamps at the

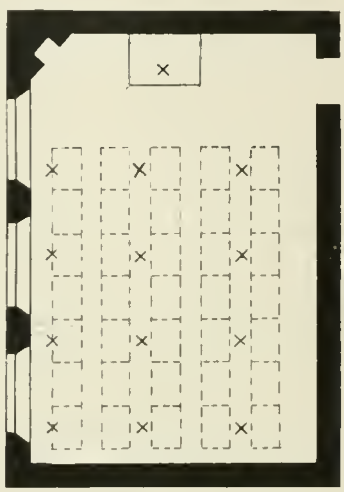
* From Schulhygiene, Baginsky, 1898

positions A, B, C, D, hung at a distance of 9 ft. from the floor—which would be about 6 ft. 6 in. above the level of the tops of the desks. It is urged that with the smallest of the standard sizes of Siemens regenerative lamps the room will be adequately lit, the lighting being arranged to come from the left, so that, while the seat marked with x is the farthest possible from any lamp, it is well above the minimum standard of light necessary for reading and writing. Welsbach burners or acetylene lamps placed in this way would provide an excellent illumination for a class-room.

Number of Lamps required for Electric Light.—In the case of electric incandescent lamps it is of great importance that there



32. Diagram showing Positions for Four Siemens Gas Lamps.*



33. Diagram showing Positions of Electric Lamps.

should be a large number of lamps in order to make sure that the light will be well distributed. As regards the actual candle-power, it should certainly not be less than for gas, for, as remarked above, electric light does not seem to carry well, and further, the effective light of the lamps decreases after they have been in use for a short time. One 16 candle-power lamp to every 50 sq. ft. of floor space will give a satisfactory illumination. It certainly should not be allowed to fall below this amount.† That will allow for a class-room, 30 by 20 ft.,

* From Schulhygiene, Baginsky, 1898.

† Electric Lamps and Electric Lighting, J. A. Fleming, London, 1899.

twelve 16 candle-power lamps. These would probably be placed in pendants of three lamps, but much more satisfactory diffusion will be obtained by distributing them singly, so arranged that no lamp is more than 6 ft. from the one next to it. Fig. 33 shows a suggestion for the arrangement of the lamps to ensure good and effective illumination. A lamp that can be raised and lowered is placed over the teacher's desk or table.

Another method of lighting which has been tried to some extent in Germany is that of indirect lighting, in which the light is thrown on to the ceiling, and is so reflected in a pleasant and diffused form all over the room. It is of course necessary to have a very strong light, an electric arc being usually employed to ensure there being sufficient light in the room for work.

There should be one gas light or one electric light in each room that can be turned on for the purpose of cleaning, without having to use the others at the same time.

CHAPTER V.

SECONDARY DAY SCHOOL BUILDINGS

(Continued).

ROOMS FOR THE TEACHING OF NATURAL SCIENCE AND ART.

Scope of the present Chapter—School Laboratories as compared with those of Technical Institutions—Objects of Science Teaching—The "Heuristic" Method—The Equipment of a Room necessary for this Method of Teaching, and Apparatus—Number and kinds of Rooms required, and their Purposes—The Grouping of the Different Rooms—**Chemical Laboratories**—Arrangement, Lighting of, and Position of Benches—The Working Bench, and its Dimensions—Shelves and Cupboards—Fume Closets, Details of, and Examples—Small Fume Hoods—Lockers—Sinks—Wooden Troughs—Waste and Drainage—Examples of Laboratories—Cowper Street Foundation—Birmingham High School—Felstead School—**Physical Laboratories**—Requirements of—Biological Room—Lecture Room and Demonstration Table—**Studios**—Size required—Lighting of.

THE arrangement and fitting up of laboratories for advanced chemical work such as are found in the large technical institutions lie beyond the scope of a book purporting to deal with schools, and the following chapter does not propose to do more than to try and show with some illustrations the kind of laboratories and arrangements that are now expected in any good Secondary School.

There has arisen in recent years so strong a feeling that natural science should form part of the ordinary curriculum that no school can now be considered complete that has not facilities for the purpose of teaching science. Since its chief value lies in the training it gives to the habit of accurate observation and in arousing the reasoning faculties, it is necessary that the pupils should not only see the experiments done, but actually perform them for themselves. For this purpose it is necessary to supply laboratories of considerable size, in which a large number of pupils can carry on experimental work at the same time.

But while all the masters and governing bodies have readily agreed to the desirability of teaching natural science to some extent,

there is no agreement as to exactly what should be taught; what is the best method of arranging a school laboratory; or how much it is necessary to provide in the way of apparatus, &c.; and since most teachers of natural science have their own views on the subject, the more inquiries that are made the more difficult it becomes to find any common basis of agreement. Science teachers are sometimes liable, in their enthusiasm for the subject, to lose sight of the educational object of the teaching of science, in trying to cram too much knowledge into the pupils in order that they may do well in examinations, rather than to train them in method and observation; and so, by doing work more advanced than is really necessary, they require elaborately equipped rooms and expensive apparatus; whereas for the majority of the boys and girls who learn natural science the real benefits may be gained without any very great acquisition of chemical knowledge and without elaborate machinery. They can, it is argued, be equally well induced to use their brains and train their observation on the simpler sort of experiments. Where there are boys and girls preparing for natural science scholarships, &c., at the Universities, the case is different, and good and well-equipped laboratories are essential. For the many boys and girls who learn natural science without any idea of going on with it after leaving school, it is not necessary to have any very elaborate arrangements. Unfortunately there is often a feeling that unless there is a splendid laboratory, well fitted up, there is no chance of doing any proper science teaching. The tendency of this is to make such teaching appear as a luxury beyond the reach of a school which has not a fair command of money. So it often happens that the laboratories in schools are much too apt to be merely copies, as far as the money can be provided, of those found in the large science colleges. Such laboratories, though erected with great expense and care, and excellently adapted for advanced chemical work, are often not as well fitted for teaching elementary classes, for which the essential requirements are plenty of room and easy supervision. It may often happen that a laboratory will better suit school requirements where there are one or two benches fitted for advanced work, involving quantitative analysis, &c., while the greater part of the room can be arranged more simply for elementary work.

In the second volume of the "Special Reports" Professor Armstrong gives an account of what is required for the teaching of elementary science on the "heuristic"* method, of which he is so

* The heuristic method implies teaching in which the pupils find out things for themselves by deducing them from the experiments.

strong an advocate, laying great stress upon the fact that elaborately arranged rooms are not necessary. The following account of what is required in the way of arrangement is drawn from that article.

There should be ample room provided. Benches of the kitchen-table type, but which need not be fixed, suffice for nearly all purposes. These must be provided with gas but not with water; one or two long sinks made of wood—elongated washing-tubs—and conveniently situated, being sufficient to meet all the requirements of a large class; more are only provocative of endless trouble and untidiness, due to constant spilling of water. In most schools, together with movable benches such as have been referred to, it will be desirable to provide one or more benches fixed against the wall of the room, having cupboards fixed in the space underneath. Four cupboards may conveniently be constructed in two tiers under the length of bench provided for a single worker. A tray which will slide in and out may with advantage be fitted at the top of each such cupboard. It is quite unnecessary to construct the bench tops of expensive hardwood—any well-seasoned wood will suffice; but, whatever the wood, it should be made impervious to water, acid, &c., by ironing in paraffin wax.

As operations involving the production of unhealthy or unpleasant fumes need very rarely be conducted, a single draught cupboard is sufficient. This may conveniently be fixed behind a long narrow demonstration table placed on a raised platform at one end of the room. A considerable amount of the wall space behind this table should be converted into blackboard by pinning against it on a light wooden framework the specially prepared black canvas sold for this purpose.

As to apparatus, it should be gradually provided to meet requirements as they arise, and every effort should be made to utilise ordinary articles—medicine and pickle bottles, jam-pots, saucepans, &c.—and to construct apparatus as far as possible in the room, for which purpose a small carpenter's bench might be provided. "Infinite injury is done at the present day, invaluable opportunities of imparting training are lost, by providing everything ready-made." * But certain things must be provided, such as foot-rules, T-squares, and set squares, and, most important of all for the heuristic method of teaching, proper balances, which should be kept under cover when not actually in use.

Such is the arrangement and apparatus necessary for Professor

* The Heuristic Method of Teaching, Prof. Armstrong, Special Reports, vol. ii., pp. 389-413.

Armstrong's method of teaching science, and it must be a poor school that cannot make some shift to teach natural science in this way.

Rooms required. — The ordinary school equipment for the purpose of teaching natural science consists of a separate laboratory for practical work in chemistry and in physics, a small well-lit room for balances separate from but in close connection with the chemical laboratory, and a store-room to each. A lecture-room common to both is almost a necessity, and in addition to these a small room that can be easily darkened for optical experiments. In the case of small schools, in which the number of scholars is small, it often becomes necessary upon financial grounds to use the same room for both chemical and physical work. While such an arrangement is not altogether satisfactory, a combined room can be arranged that will work tolerably well when the work is of an elementary character.

It is now possible for students who intend to take up a medical career to undergo their first year's training while still at school, provided that there are proper facilities for teaching the necessary subjects in the school. In order to meet the requirements of these students a room for the purpose of teaching biology has to be added to the foregoing. A biology room is of course often found in schools where there is no intention of training pupils for a medical career.

In many schools a small additional chemical and physical laboratory, where a few advanced scholars can do special work, and for the use of the science master, will be found a great convenience. A small room should be provided for the senior science master or mistress for clerical work.

Grouping of Rooms.—The above rooms should if possible be arranged together in a group. The plan of separating the chemical from the physical laboratory by means of the lecture-room (see Fig. 36) has several advantages. Apparatus for demonstration during lectures has not to be carried any distance. A class can pass easily and quickly one to the other, while the passage or corridor can often be so arranged as to come under the higher rows of seats in the lecture-room and so economise space.

The plan of devoting the top floor of a school building to the purpose of science has much to recommend it. By means of top lights not only can excellent lighting of the room be ensured, but it enables all or nearly all the wall space to be utilised for the purpose of shelves and cupboards. This is of no small advantage in a chemical laboratory, where there seems to be always a demand for more shelf space, how-

ever large the initial provision. Effective ventilation is again easier to manage. The disadvantage of such a position is chiefly felt in the physical laboratory, owing to the difficulty of providing tables sufficiently steady and unaffected by vibration to allow of delicate experiments; but, while this objection would be fatal in the case of an institution where very advanced or original research work was being carried on, it is possible by taking precautions to obtain quite sufficient steadiness for ordinary school work.*

Chemical Laboratories: General Arrangement.—The main requisites in a chemical laboratory are plenty of room for the students and ease of supervision for the teacher. The position of draught cupboards, reagent shelves, waste receptacles, &c., should be so arranged as to reduce the necessary moving about to a minimum.

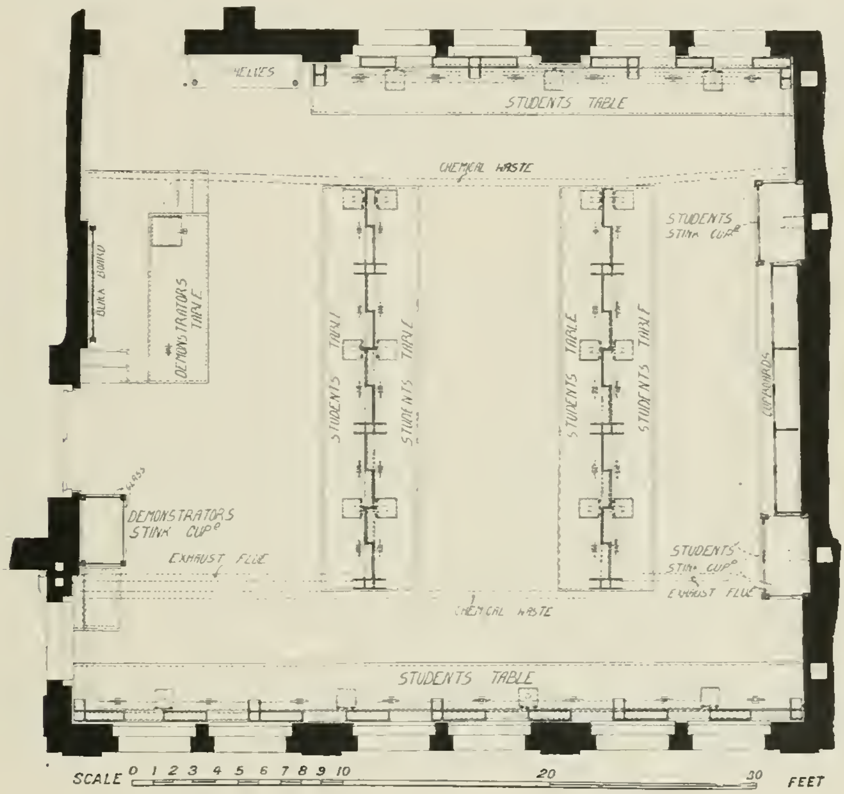
For the purpose of lighting, the working benches may be arranged so that their greater length is at right angles to the wall in which are the windows. In this way the light will be least interfered with by those working at them. It is usual, in addition to the benches in the middle of the room with pupils working both sides, to have a single row against the walls. Objections are sometimes made to the latter system on the ground that it is difficult for the teacher to see what the students at those benches are doing, as they have their backs to him and so hide their work, while inspection of cross benches is easy to any one walking down the room.

A demonstration table on a raised platform, and fitted with gas, water, and a down-draught fume closet for the teacher, is commonly placed at one end. This is indispensable in cases when there is no separate lecture-room. Behind the table should be a large blackboard hung with the Kelvin patent counterweights, so that it can be easily run up and down. It should be possible for all the students in the room to be able to see the demonstration table without having to move from where they are working.

A question upon which there is considerable difference of opinion is as to the advisability of placing in the laboratory itself a number of desks to seat say thirty or forty pupils for the purpose of giving a collective lesson in cases where there is no lecture-room. When the laboratory is small and there is any pressure upon space it is probably better to omit them; but, provided the room is large, they will not in

* There are some very valuable suggestions as to the arrangement and relative positions of science rooms in a paper read to the Architectural Association on the Design of Technical Schools by Professor Garnett on 15th January 1892.

any way interfere with the use of the laboratory, and most teachers speak strongly in their favour, as many lessons can be as well given to forty as to ten. The absence of seats makes it necessary, perhaps, to give the same lesson twice over to the pupils in their places at the benches, which is, on other grounds, not considered a desirable arrangement, since it usually involves their standing. The difficulty is sometimes met by placing the working benches across the room with pupils placed only on one side of them, so that they are all facing the teacher's



34. Chemical Laboratory, Cowper Street Foundation School. For Thirty-four Students.

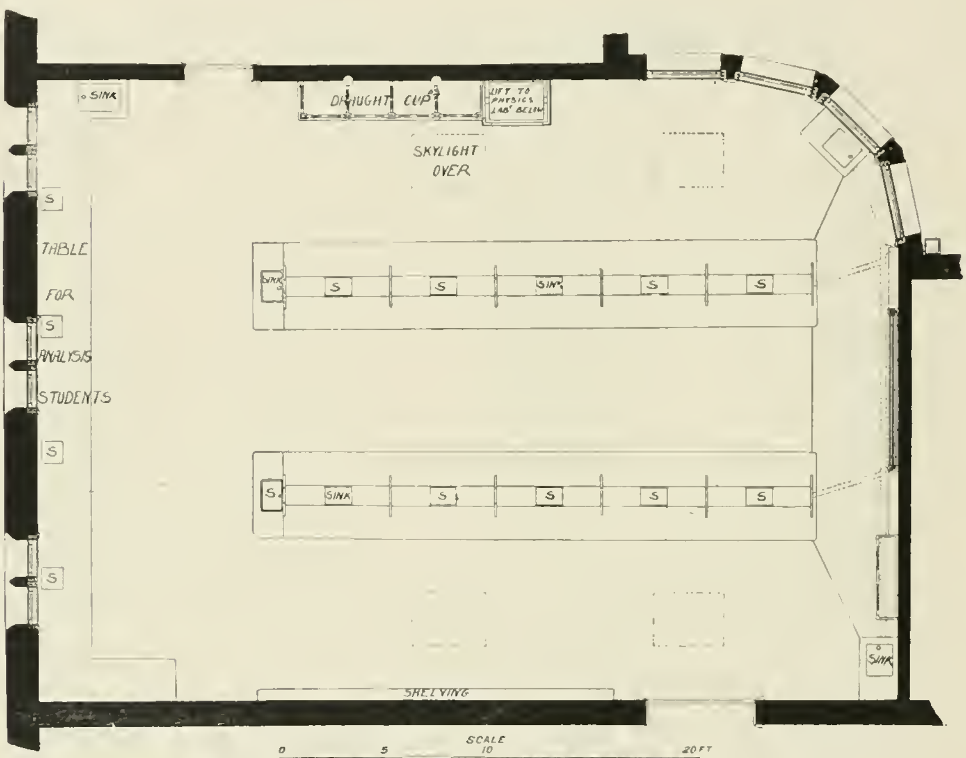
H. Chatfield Clarke, Architect.

demonstration table. The benches in this case are made narrow, and stools are provided so that the students can all listen to a demonstration table without turning round in their places.

If the benches run the long way of the room, since it is necessary to pass up and down behind those working, it is essential to have the gangways of considerable width, for those at work may at any time take a step backwards at the moment some one is passing down the

room, or in other ways collisions will be frequent, and may cause disastrous results.

The chemical laboratory illustrated in Fig. 34 is that of the *Cowper Street Central Foundation School for Boys.* This is a large and excellently equipped laboratory, very carefully arranged. The room measures about 35 by 32 ft., and provides accommodation for thirty-four students, giving a gas-jet to each, and a sink and small fume hood to every pair of students. There are two large draught closets



35. Chemical Laboratory, The High School for Girls, Birmingham.
J. A. Chatwin, Architect.

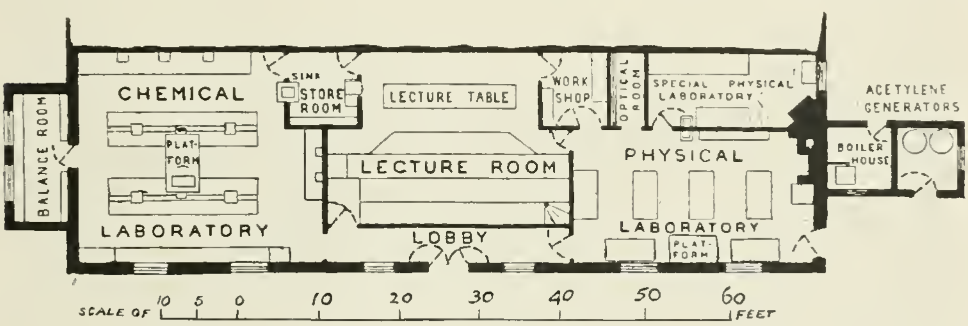
for the use of the students, and another for the master close by the demonstration table, placed on a raised platform at one end of the room. The arrangements of the exhaust flue and waste pipes are shown on the plan. Each student has a set of the usual reagents placed on shelves immediately above his working place.

Fig. 35 shows the laboratory at the Birmingham High School for Girls. The arrangement of the benches, which are fitted with wooden troughs, is fully described below. The teacher's desk comes close to

the end of the working benches; this makes it possible to take the waste pipes from the benches to the hall, underneath the raised platform, leaving the floor intact, movable boards being arranged so as to provide easy inspection.

There is one bench arranged especially for students who are doing work in analysis. Four fume closets are also provided which are illustrated below. A convenient feature is a lift connecting this room with the physical laboratory below. The floor of the room is covered with red paving tiles, open wood-work stands being provided for the pupils to stand upon. This floor has a pleasant appearance, and, while easily washable, is not much affected by acids.

In Fig. 36 are shown the laboratories recently erected at *Felstead School.* The arrangement of the rooms was schemed by Mr Munby, the senior science master, and shows several ingenious methods for



36. The Natural Science Block, Felstead School, Essex.

making the most of every inch of room. The building is practically divided into three main rooms, a lobby under the upper part of the lecture-room giving access to both the chemical and physical laboratory, making it also possible to get from one to the other without passing through the lecture-room. The position of the store-room and workshop should be noticed, it being a considerable advantage to the teacher to have his store-room close at hand in case anything should be forgotten. It also utilises the space between the end of the lecture table and the wall, which of course is not available for seats.

The chemical laboratory can accommodate twenty-six boys, allowing 3 ft. 6 in. for each student, there being two double benches and two wall benches in addition to a special bench 18 ft. long for special work, such as distillation, &c., having at each end a fume closet. The working benches are supplied with small fume hoods as described above. The suction draught for these as well as the larger draught

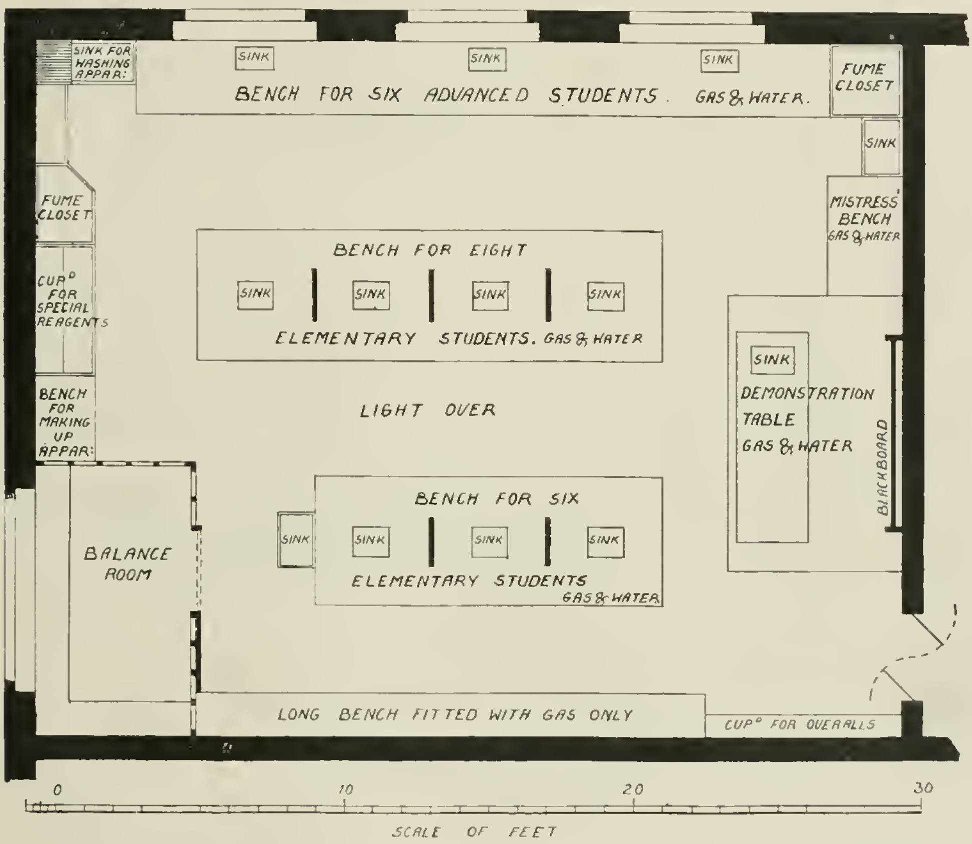
closets is obtained by arranging the ducts so that the furnace which warms the building can only draw the amount required for combustion through these openings. A novel feature in this laboratory is the arrangement for the master's table. This is arranged on a platform placed across the benches in the middle of the room. This position gives a commanding view of what every boy in the room is doing, as well as being easily seen from all parts. The balance-room is at the end divided by a glass screen, so that this also can be overlooked from the platform. The arrangement can be seen in Fig. 37, with the table and revolving chair *in situ*. In this laboratory acetylene gas has

37. Interior View of the Chemical Laboratory, Felstead School.

been in use for the last six years for ordinary experimental work, there being no possibility of obtaining ordinary gas. It is used in a special burner designed by the science master, Mr Munby, admitting air in order to get rid of the luminous effect, somewhat on the lines of a Bunsen burner, but possessing some special features. Its heating power is about double that of the ordinary Bunsen burner.

Fig. 38 shows a suggested form for a chemical laboratory for school work, arranged so as to allow of easy supervision. The two benches in the centre are intended for elementary work, and are directly under the eye of the teacher. The basins are in the centre, so that it would be possible to double the numbers at these benches, and put four

pupils to a sink, giving them 2 ft. apiece. The room would be of a sufficient size to accommodate twenty students at an examination under the regulations of the Science and Art Department. The centre benches would have one shelf only, raised a foot above the bench. The bench along the wall would be fully fitted for six advanced pupils. The balance-room is formed by glass partitions in the laboratory itself, and so all work done in there is under easy observation from any part of

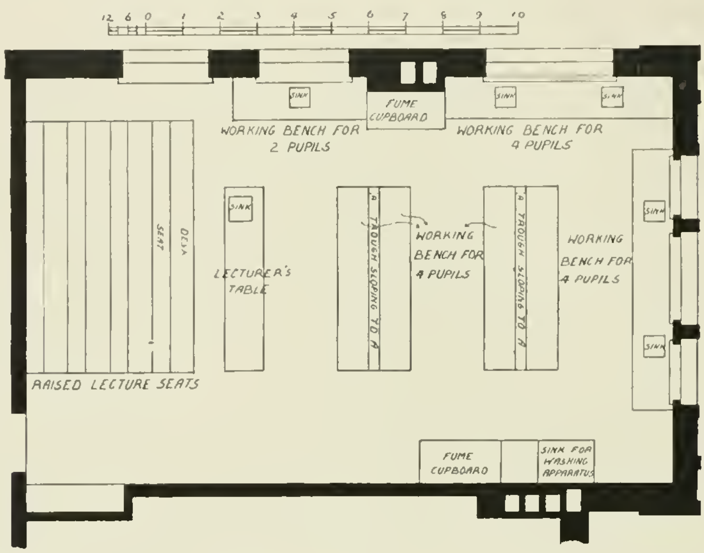


38. A Suggestion for a School Laboratory, to take Twenty Students.

the room or from the teacher's platform. The rest of the arrangement can be easily seen from the plan.

A chemical laboratory arranged with seats for lecturing purposes, as well as benches for practical work, is shown in Fig. 39. This is the laboratory at the Clapham High School for Girls now being rebuilt for the Girls' Public Day School Company. The arrangement of the room was suggested by Miss Lees, the science mistress at the school.

The nominal accommodation of the room for practical work is eighteen, but when required the numbers at the benches in the centre can be doubled. These benches are fitted for elementary work, and have a trough down the centre formed of wood treated with tar. The wall benches are reserved for students doing advanced work. The seats will accommodate forty pupils for a demonstration lesson. This arrangement of course precludes the use of a fixed blackboard behind the lecturer's table. An additional bench could be placed along the unoccupied wall.



39. The Chemical Laboratory, New School for Girls, Clapham.
The Girls' Public Day School Company.

In cases where a separate laboratory is supplied for elementary work, or in small schools where the work done is of a very elementary character, the fitting of the room can be reduced to the simplest proportions, while considerable economy can be effected in the benches themselves.

The sinks can be removed from the benches, and one or two of a larger size placed in convenient positions, either at the ends of one of the benches or against the walls. Such sinks can well be made of tarred wood. The reagents required for ordinary use will be few, and one row of bottles will probably meet all requirements. In this way the space for working will be increased, while the teacher has a clear view of all that is going on; an important point in the case of the younger pupils, whose experiments require a good deal of

careful watching and looking after. Gas for heating will be required on each bench, and if possible water should be within easy reach of all the pupils.

Such a room may well be arranged as described above, with all the benches facing the demonstration table at one end, the benches being narrow, under 2 ft. 6 in., as the pupils would only work at one side; in this way a demonstration can be given at any time without necessitating the pupils moving, and the master can pass between the rows and see what each boy is doing.*

If the shelves for the reagents are made so as to be easily removable, the whole of the bench top is available for apparatus, and the room can be used for teaching elementary physical work as well as chemistry.

Size of Room.—The size of the room required depends of course upon whether the school is large enough to have more than one science teacher. It is generally considered that one science teacher can look after twenty pupils doing experimental work. The regulations of the Science and Art Department give twenty-five as a maximum for one teacher. In order to take twenty pupils comfortably, allowing plenty of room for cupboard space, demonstration table, &c., the room should be not less than 20 by 30 ft. It is found that laboratories can be most economically built when they provide accommodation for multiples of twenty.†

Working Benches.—The benches when placed across the room are arranged so that pupils can work on opposite sides facing each other. The advantages of this arrangement are economy in fittings and gain in space. The shelf for reagents can also be put where two students can use the same set. It is open to the objection that it makes an explosion or accident more dangerous. A partition which would obviate this is very inconvenient, as it hides the work of the pupils from the teacher. The plan of having a partition of strong plate glass has been successfully tried in a number of laboratories, and is highly spoken of. Unless of fairly thick glass there would be considerable liability to breakages.

Before the best method of fitting up the benches can be determined

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* See "The Planning and Fitting-up of Laboratories," T. H. Russell. Batsford, 1903.

† Technical Institutes, Paper read to Architectural Association, S. H. Wells, *The Builder*, 15th February 1896.

upon it is necessary to settle to what degree the chemical teaching is to be carried. For instance, a very simple form of bench will suffice for a school where few of the pupils will proceed to analysis, this branch of work not occupying so prominent a position in a beginner's course as was formerly the case. For example, at the South-Western Polytechnic, Chelsea, they have benches arranged for four students, with a plain top, and while a gas-jet is supplied to each pupil there is one tap for water, and a sink placed at each end, which serves for two pupils. There is no partition in the centre, but a row of white glazed tiles on which to stand bottles. This arrangement, while answering for very elementary work, would hardly be sufficient for a school where there were any number of rather more advanced pupils. The arrangement of sinks at each end is not altogether a good one, as it does not allow of spilt liquids being swept in, in case of an upset. In school work where different sets of boys have to use the laboratory at different times, the sets of reagents must of course be common to the boys who use the stands in turn, so that it is impossible for each boy to have a set of his own, for the purity of which he is responsible. This obviates the need of supplying any arrangements of locking bars, &c., for the reagent shelves.

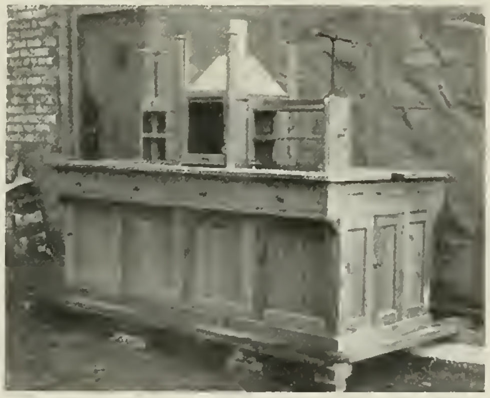
Width.—In calculating the size of the bench it is usual to allow a distance of 3 ft. 6 in.* for each student for a school laboratory; this would be increased to 4 ft. 6 in. for older and advanced scholars. A sink with a water tap is placed midway between two students for their common use, a gas-jet being necessary for each place. In the double benches with pupils working each side a sink placed in the middle will serve the purposes of four pupils.

Depth.—The bench should not be of too great a depth for an ordinary pupil to reach easily from back to front, say 2 ft. 3 in. or 4 ft. 6 in. for a double desk.

Height.—The bench should be sufficiently low to allow the student carrying on ordinary operations, such as filtering, &c., without having to raise his elbow much above its natural position. This would be for school laboratories 2 ft. 9 in. to 2 ft. 10 in., 3 ft. being usually reckoned for adults. The benches should not be less than 4 ft. 6 in. apart, so as to allow of a person passing easily between the backs of students working back to back at neighbouring benches.

* This is the distance suggested by the Science and Art regulations.

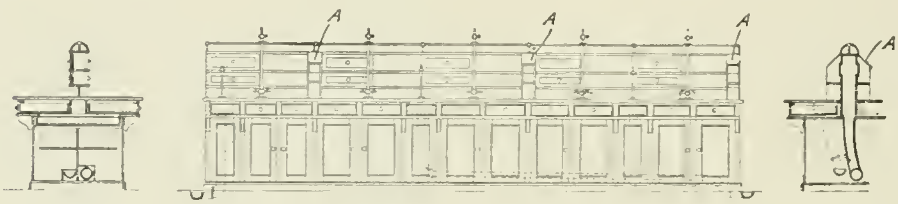
The shelves to hold the reagents in common use are of course most conveniently placed over each stand at the working benches, and should be about 6 in. wide and 9 in. apart. They are, however, sometimes placed at the end of each bench so that one set, or one at each end, will suffice for all the students working at that bench. In the cases of benches for elementary work, one shelf raised a foot or 15 in. above the desk on brackets will be quite sufficient, and will allow of easy inspection across the benches. The shelf should have a raised bead each side to prevent the bottles being pushed off. It is a convenience to have, either in the laboratory or in the store-room, a shelf that will take a good number of large bottles for the purpose of holding solutions of known strength sufficient to last a year or eighteen months, as these are often troublesome to make up. Fig. 40 shows an arrangement for a working bench for four students arranged with a fume closet in the middle. In Fig. 41 are shown details of the benches in the laboratory illustrated above, Fig. 34. These benches are very fully fitted. A small fume hood A is provided for each pair of students. The shelves for reagents are arranged alternately each side. The wastes discharge into an open channel (see section, Fig. 41, A), while an exhaust flue is taken through all the benches (Fig. 41) to provide for the draught hoods.



40. A Working Bench for Four Students, with Fume Closet in the Centre.

There should be in every laboratory a plentiful supply of cupboards and shelves of considerable size, and the shelves should be a sufficient distance apart vertically to allow of large apparatus being placed upon them. The cupboards should not come right down to the floor, but leave a small space under for the purpose of cleaning. When, as is usual, the lower part of the benches is filled in with cupboards, it is as well that a space should be left under each bench for a rubbish basket, as the less distance it is necessary to carry broken glass, &c., the better. Wicker baskets with strong handles and lined with tin serve the purpose well, and are light to lift. A strip of glass arranged to fit the shelves on which the reagents stand will add much to the clean appearance of the laboratory.

The material used in making the benches is either deal or pitch pine, but there is considerable difference as to the most suitable material for the top of the working bench. Whatever is used, it need hardly be said, should be as durable and impervious as possible, as far as possible non-absorbent, and not liable to shrink or crack when exposed to the heat resulting from the use of burners employed in heating flasks, &c. Teak is probably far the best material, but is really a needless expense, as deal or American basswood properly treated will answer the purpose well. The top must be thoroughly waxed. Paraffin wax should be used for this purpose, as ordinary oil and wax are soon affected by alkalies, and also, but more slowly, by acids. Tops treated with paraffin are, however, open to the objection that the wax is liable to melt when exposed to heat. The use of asbestos mats is suggested to meet this difficulty. Wooden tops covered with 7 lb. lead are sometimes found. They are in use at Finsbury College and Bristol University



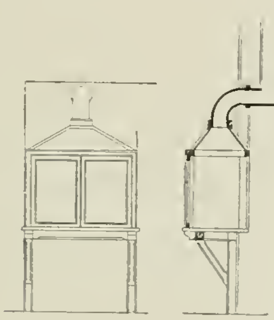
41. Details of Working Bench from the Chemical Laboratory in Fig. 34. A, Small Fume Hoods.

College. Such tops are very satisfactory, but it is not necessary to go to the expense of such a provision for school work. It is probably not more apt to break glass apparatus than hardwood. A small bead along the edge of the benches is a useful addition, to prevent things rolling or slipping off.

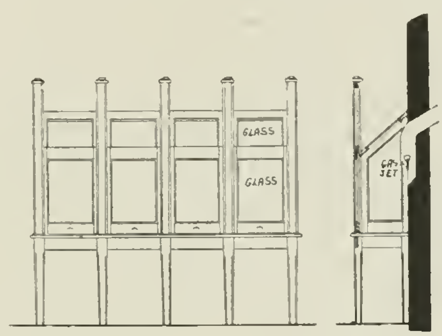
Fume Closets.—Fume closets are provided in laboratories so that experiments involving the production of noxious gases can be carried out without vitiating the air in the laboratory. They consist usually of a small cupboard with glass front and sides measuring from 2 to 3 ft. in height, 2 ft. wide, and 1 ft. 9 in. in depth. The size is of course open to considerable variation. They are placed usually against the wall of the room, so that the ventilation flue can be more easily managed, and in a position easy of access to the benches. The size of the fume closets should be limited to that of the largest apparatus that is likely to be used in them, since the object being to get rid of the gases formed as quickly as possible, the smaller space there is the better.

The Number Required.—It is usually found that one fume closet to every five students will meet the ordinary requirements of a school laboratory. Where small draught hoods * are supplied on the working benches, one large closet, or at the most two, will be all that is required. The front of the closet has to be made so that it will run easily up and down; this is usually done by means of sashes and pulleys. The pulleys should be large and run easily. The annoyance caused by breakage of the lines and the liability of disarrangement has led to the adoption of a light sash running in a groove, with small spring attachments that hold the sash in any position in which it is put.

It is necessary of course to provide some means for the admission of air when the closets are in use. Leaving the front sash raised causes considerable disturbance to the flame of the gas used for heating inside. This difficulty is commonly met either by having some sort of subsidiary sash openings at the sides or small holes pierced in the bottom of the closet. In order to prevent the escape of noxious fumes, when



42. FUME CLOSET.



43. A ROW OF FOUR FUME CLOSETS.

the sash is raised, through the opening between the inner side of the glass and the upper edge of the closet, some sort of automatic closing arrangement is required. The use of a thick piece of felt on a lath, so arranged as to press against the glass as the sash moves up and down, will answer the purpose.

The construction of a fume closet is shown in Fig. 42, which illustrates one at present in use at the laboratories at the Central Foundation School, Cowper Street. In Fig. 43 is shown a range of four fume closets, as built in the laboratory at the Birmingham High School. A gas-jet is placed in the flue to provide for the exhaust. An inexpensive fume closet made by the North of England School Furnishing Company is given in Fig. 44. This is placed against a wall of glazed bricks.

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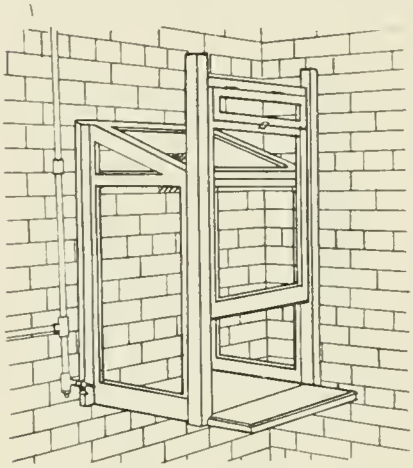
* For description of these see page 118.

The chief difficulty to be met is the destructive effect of the combination of acid fumes, moisture, and heat, upon any material that is used for the top of the closet.

Slate and glass are commonly used, but do not stand heat well, being liable to crack, while the condensation upon these materials, as well as upon stone, is an additional inconvenience. Wood coated with tar or pitch stands fairly well, but if much heat is used is apt to warp and crack. Mr Robins suggests that probably the best and cheapest roof would be one made of enamelled iron, cast in the size and shape required, and coated with some enamel that would resist the action of acids.* The bottom is formed usually of lead or slate, with a groove and small drain to carry off liquids.



44. A Fume Closet.

A fume closet at the Imperial Institute, arranged by Professor Dunstan, has been covered with white glazed tiles, with very satisfactory results; the gain in light also being of considerable advantage. The extract flue should of course not be carried vertically out of the centre of the closet, as condensed liquids and dust are likely to fall from it, and considerably interfere with any experiment being carried on beneath. The usual plan is to place it high up at the back of the closet. Replacing the ordinary round or square hole by a long slit the width of the closet has the advantage of reducing the corners where stagnant air can lurk.

The draught is commonly obtained by the use of a gas-jet in the chimney, or in large institutions by the use of a fan. The gas-jet is very unsatisfactory owing to the impossibility of preserving the iron from corrosion by the fumes. A small fan driven by electricity where the current is available, and which can be obtained for £2 or £3, is usually much more satisfactory. The furnace for heating is sometimes utilised for the purpose of producing the necessary draught. Special closets for sulphuretted hydrogen, &c., hardly lie within the question of school laboratories.

Small Fume Hoods.—In addition to the large fume closets it is now common to find in laboratories small fume hoods placed on the

* Technical School and College Building, p. 122.

working benches, one to each pair of students. These are usually formed of wood with a sloping movable glass top (see Fig. 41). They are all connected with an exhaust pipe, taken to a flue with a strong upcast draught, gained either by the utilisation of the heat of the furnace for warming the building, by an electric fan, or otherwise. These serve for the purpose of experiments involving the production of a certain amount of bad gas, but not a sufficient quantity to make the use of the big draught closet necessary. This plan has been adopted in many schools, and is found a great convenience. The gas-jets are in some cases so arranged that no heating can be done except under these hoods. The only objection I have heard to the use of these small draught closets is that their small size concentrates the fumes, and so is likely to cause rapid corrosion.

Lockers.—There is considerable difference of opinion on the question as to the desirability of supplying a locker for each student. It is perhaps hardly possible to do so in a large school where the number of pupils learning chemistry is very large. With an ordinary laboratory it is usually possible to get in about three times as many lockers as there are working places. It is usual to have a drawer with a cupboard underneath it. In the case of older pupils doing more advanced work it is a great convenience that some place should be provided where they can keep their own apparatus or safely put away an unfinished experiment. There is an ingenious arrangement at Felstead School by which much time and confusion is saved; there are under each working place three sets of drawers and cupboards; the cupboard shuts with a spring lock, and when shut also locks the drawer. The boys learning chemistry are in three sets. The cupboards are so arranged that each set or class of boys has one cupboard in each set of three, so that in each case the owner of the cupboard has his place at the bench immediately above it, while the owners of the other two cupboards belong to another set working at a different time. By having different coloured labels for the names for each set of boys it is easy for the laboratory attendant to go round and open all the cupboards of the class that are coming in. If there is not sufficient space to allow a cupboard to each pupil who uses the laboratory, room may be found to supply a fair-sized drawer.

WASTE AND DRAINAGE.

Sinks.—The sinks are made square, usually with flat bottoms, in order that when required they can be used for pneumatic troughs.

though this use is not very often feasible. They should be fixed level or rather below the surface of the bench in order that spilt liquids may be swept freely in without obstruction. This makes their removal in case of breakage somewhat difficult, but if made of thick glazed stoneware this is an unlikely contingency. A movable and close-fitting top is sometimes useful, as it enables apparatus to be placed upon the top when necessary.

The important point in connection with the waste from the laboratory benches is to provide easy access to every part of it, so that the obstructions which are sure to occur can be readily got at and removed. This is sometimes done by merely running the waste along open gullies in the floor. There should always be an arrangement which will allow the waste to deposit most of the solid matter it carries with it. Professor Garnett * suggests that it should be arranged in the following way—that there should be a sufficient space left in the centre of the benches to allow of a man passing through. This space serves to carry the gas and water pipes and the drainage trough. The latter may be made of 1 or 1¼ in. red deal boards, jointed so as to form a V trough about 6 in. deep. The trough is thoroughly caulked with a mixture of pitch and tar, put on hot, and this trough serves to collect the drainage from the sinks, and deliver it to a sludge box or small settling tank through an overflow on one side. The overflow from the sludge box is delivered into a similar trough laid in a chase in the floor, which conveys it to the downcomer outside the wall. In place of V troughs, semicircular troughs cut from the solid in red deal may be employed. These semicircular troughs are largely used in chemical works, and avoid the joint of the V trough. For the downcomer, best stoneware pipes, salt glazed, may be employed, but cast-iron pipes coated with preservative compound will last a very long time, and some experiments will probably be made shortly upon the suitability of enamelled cast-iron pipes for this purpose. Rectangular troughs have no advantage over V troughs, and only offer a much larger surface for the acid liquids to act upon. The chases in the floor which may carry gas-pipes, water-pipes, pipes for distilled water, compressed air for the blow-pipe, and vacuum for filtration purposes, in addition to the drainage troughs, should admit of being opened throughout their whole length for the purpose of inspection.

The necessity of supplying a number of sinks with their plumbing, a costly item in laboratory fitting, can be obviated by the use of

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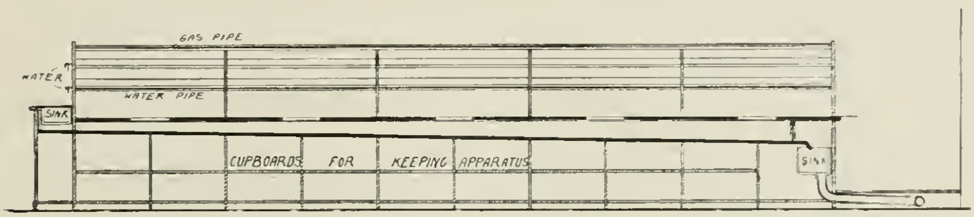
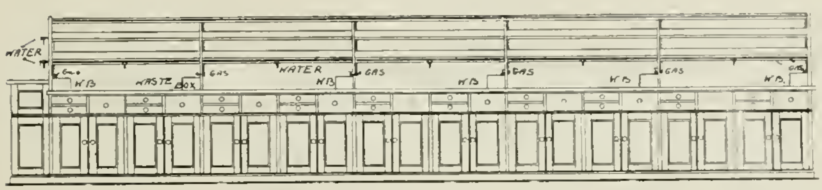
* The Design of Technical Schools. Paper read to the A.A. by Professor Garnett, 15th January 1892.

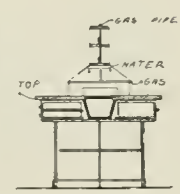
properly-treated wooden troughs or boxes. A method of doing this is shown in Fig. 45. The ordinary stoneware sinks are replaced by a long wooden trough which runs the full length of the benches, covered by short lengths of board easily removable, so that it can be opened and made to form a sink at any convenient spot. The trough is coated thickly with a preparation of tar, and laid to a rapid fall, discharging into a collecting sink, where any solid matter is deposited. At the end of the trough is a grating to catch any large solids. This illustration shows the arrangement as working at the Birmingham High School for Girls. A plan of the laboratory is shown, Fig. 35. This use of tarred wood provides an effective and economical method by which the



SECTION OF LONG TABLE.



SIDE ELEVATION OF LONG TABLE.



CROSS SECTION OF LONG TABLE.

45. DETAIL OF WORKING BENCH FROM FIG. 35, SHOWING THE USE OF A WOODEN TROUGH IN PLACE OF SINKS.

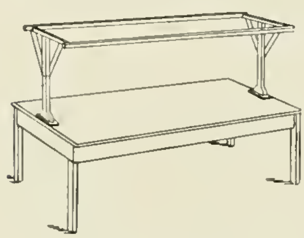
cost of fitting up a laboratory may be much reduced. It can be equally well adapted to form large sinks of the ordinary type. There should be a collecting vessel underneath where the solid matter that is washed through may be deposited. This is arranged so that it can be easily taken out for cleaning.

For arrangements of benches and fittings of a more advanced character, a large amount of information will be found in Mr Robins' book mentioned above.

Physical Laboratories.—The main desideratum in a physical laboratory is a large working table steady and free from vibration—a somewhat difficult matter to secure. Various methods are in use—

stone brackets and stone or slate tables built into the walls, with and without stone brackets; sometimes, where possible, stone or brick pieces are brought up from the basement to about 3 ft. above the floor with a heavy stone or slate top. In these cases care has to be taken that the floor boards or joists should not be in actual contact with these piers, or the vibration caused by persons moving about the room would of course be communicated to the piers.

There is even more difficulty about settling as to the exact requirements of physical than in the case of chemical laboratories, as there is such a large variety in work done there. However, as long as the tables are steady and there is plenty of room, it will probably answer most purposes. It is usual to supply gas to each place on the working benches or tables, but not water or sinks; one or two large sinks with water-taps in convenient places being generally considered sufficient. Shutters arranged so that windows can be easily darkened quickly are desirable for optical work. There should be arranged above the benches (see Fig. 46) a high framework, with hooks, to which can be attached apparatus such as pulleys, &c., for mechanical experiments.


46. Table for Physical Work.

The arrangement of a room for quite elementary work should be as simple as possible. Perhaps the most important provision is that of ensuring complete and effectual supervision; the pupils will presumably be young, and the place is full of attractive novelties—a welcome change from the class-rooms. The tables should be narrow, from 1 ft. 10 in. to 2 ft. 6 in. in width, so that the pupils work on one side only, and all face the same way; this not only enables an easy view to be obtained, but makes it easy for the teacher to give a demonstration at any moment. About 3 ft. of bench should be allowed for each pupil, and if possible a set of apparatus apiece. The plan of allowing work in pairs doubtless economises apparatus, but has little else to recommend it.

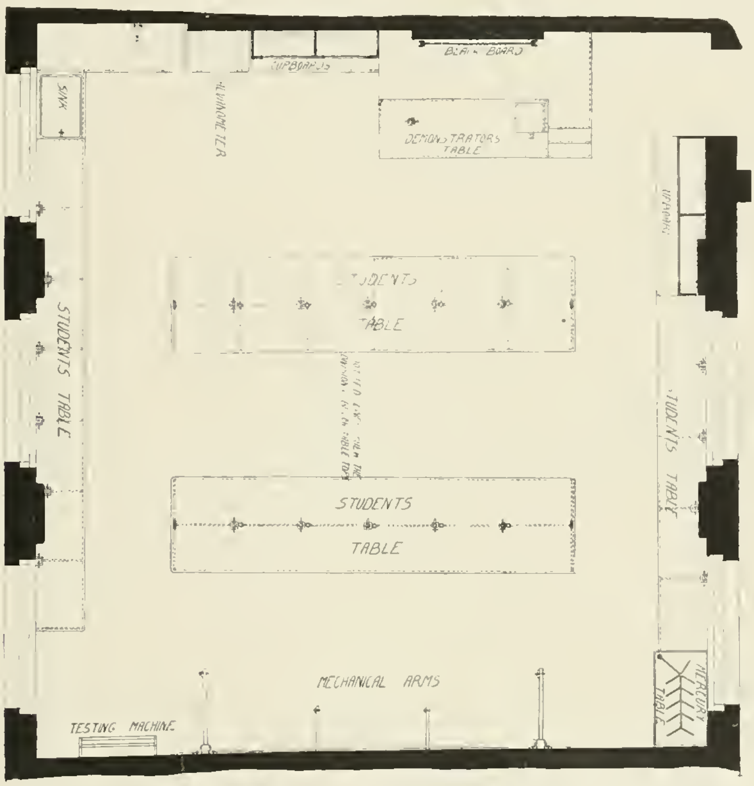
To take twenty-four pupils comfortably, and allow plenty of space for the storage of apparatus, cupboards, &c., the room should be about 36 ft. by 28 ft.*

The tables for a room of this kind should be simply tables of the

* "The Work Book for Elementary Physics." Alfred Earl. *The School World*, January 1904.

ordinary type, but made unusually heavy and solid, the legs not less than 4 in. square, and the tops formed of teak, into which paraffin wax can be ironed at intervals.

In the physical laboratory at Felstead (see Fig. 36) tables of this sort are in use, and are not fixed; the gas being supplied by pendants from a main running along the roof. These pendants are



47. The Physical Laboratory, Cowper Street Foundation School.

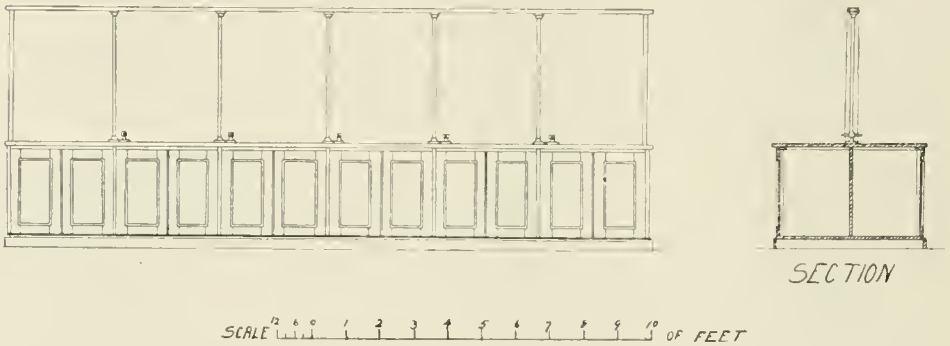
H. Chatfield Clarke, Architect.

jointed, and can be doubled up to a height of 7 ft. from the ground when the proximity of iron is undesirable.

Fig. 47 shows the physical laboratory of the Cowper Street School, the chemical room of which was illustrated above. The benches are here fixed, a gas-jet being supplied to each place, but not sinks; one large sink being considered sufficient for the room. Over each bench is a framework for the suspension of apparatus (see Fig. 48), while at the end of the room are arranged mechanical arms for larger experi-

ments involving the use of considerable weight. A mercury table is placed in one corner. A specially arranged shelf, secured against vibration by being built into the wall, is provided for the purpose of experiments involving the use of the galvanometer. A demonstration platform with table and blackboard completes the equipment.

Biological Room.—The room for the study of biology need not be of any great size, as the number of students taking this subject is not likely to be large. It should be well lit and well ventilated. Benches, steady enough not to be moved by the pressing of the hand, in the windows, either low or provided with high stools for the purpose of microscope work, are required. A large sink, and a supply of water



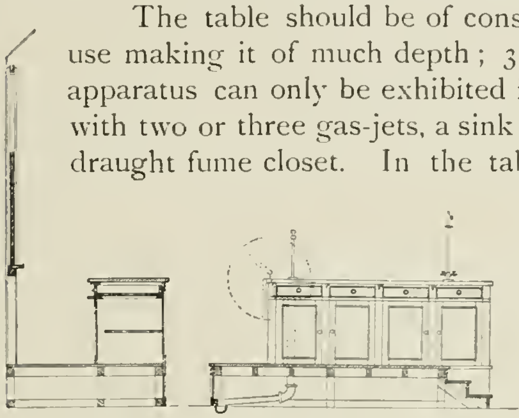
48. Benches in Physical Laboratory illustrated in Fig. 47.

and gas, with shelves, cupboards, &c., are of course necessary. A room of this kind will of course answer equally well for the purpose of teaching botany or natural bistory.

Lecture Room.—The lecture room, as mentioned above, should be readily accessible from both the physical and chemical laboratory. If it can only be placed in connection with one, it is probably better to put it near the physical laboratory, as the apparatus that will be required in the lecture-room for physics teaching is often very heavy or very delicate. Again, if electrical experiments are being shown, it is often necessary to keep the apparatus outside till the moment it is required, in order to ensure of its being of the necessary dryness, &c. In large institutions it is of course necessary that the lecturer's table should be absolutely free from vibration, and so this room is usually placed on the ground floor. But the elaborate arrangements necessary

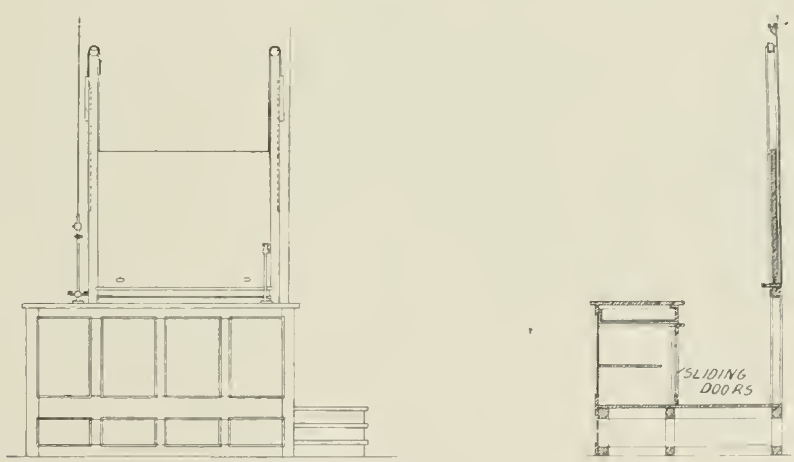
to ensure this and the other devices and contrivances found in such rooms are hardly necessary in an ordinary school lecture-room.

The table should be of considerable length, but it is of little use making it of much depth; 3 ft. will probably be sufficient, as apparatus can only be exhibited in one row. It should be fitted with two or three gas-jets, a sink with a movable top, and a down-draught fume closet. In the table shown in Fig. 49 there is a large sink with a movable cover to turn over, shown by dotted lines; the back of the table is fitted with cupboards, &c., and the position of the blackboard is shown. Fig. 50 shows a simpler form of lecturer's table for physical lectures.



49. Demonstration Table (Inside Elevation and Section).

There should be some space left between the lecturer's table and the wall behind; this is necessary both to allow plenty of room for the master and his assistant, and for certain experiments, such as for instance where a beam of light is thrown from a galvanometer on to a scale upon the wall. Eight feet is not perhaps too much. The light should of course be



50. Demonstration Table.

arranged with the view of lighting the demonstration table and the blackboard behind it. If the lecture-room is on the top floor, a lantern in the roof will often provide a good light. The windows should be arranged with screens that can be easily drawn when it is required to darken the room.

A piece of the wall behind the demonstration table should be prepared for the purpose of magic lantern exhibition. A square of 12 ft. is large enough for most purposes, while 16 ft. may be regarded as a maximum. An excellent surface can be obtained by finishing the wall with Parian cement, and giving it two coats of plain lime whiting. Across this the blackboard may be placed. In this case it must be movable, and may be fitted with the Kelvin principle of counterbalancing weights, so that it will run easily up and down. A platform or shelf for the lantern itself must be provided at the back of the room. If this is required to show any delicate experiments, it will be necessary to bring a brick pier up to carry it, which must be kept quite independent of the seats.

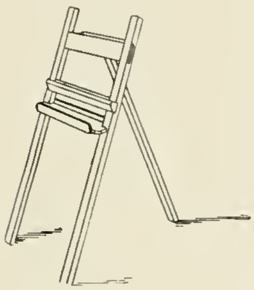
A few hooks fixed in the ceiling, or better still an opening into the room above, exactly over the demonstration table, for the purpose of suspending apparatus, is often of great convenience.

The seats have to be arranged in rising tiers in order that every one may have a free view of the lecture table. This should be arranged so that each pupil may see the whole table, even if the person in front is two or three inches taller. In cases where the room is small and the seats have to be brought close up to the demonstration table, the gallery will have to be inconveniently steep if every one is to see the table well, but by increasing the distance the steepness of the slope is rapidly reduced. The table should be not less than 5 ft. from the first row of seats. The rows of seats may rise from 6 to 12 in., increasing in height towards the back. It is usual to provide 20 in. for each place.

A small workshop in connection with the science rooms is a great advantage; this need not be more than about 8 or 10 ft. square. It should be fitted with a small bench, a vice, and tools for working in tin and zinc, soldering materials, &c.

Studios.—The main requirements of a studio are a steady light, which should be ample and under easy control, and plenty of space. The steadiness of light is usually obtained by making the studio window face to the north. Probably the best aspect is rather to the east of north. Opinions differ as to the relative advantages of top light and side light, but whichever form be adopted it should be carefully arranged so that it comes from one direction, in order to avoid any danger of cross lighting. When the light is brought in by a vertical window on one side it is necessary to make it of a much larger area than in the case of a top light. The sill should be at least 6 ft. from the floor.

A long narrow room with a window running down one side often forms a convenient shape for a studio for school purposes, as it is easy then to cut it up by means of curtains or otherwise to suit divisions doing different work. The window should be fitted with blinds, which should be arranged to draw up from the bottom, or curtains, arranged so that it may be easy to adjust the light to suit the various purposes. The studio is usually placed upon the top floor in order to secure a good light.



51. The Englefield Easel.

Area Required.—This should be ample. At least twice as much floor space per head as is required for a class-room should be allowed. Drawing is now one of the regular school subjects, so that the studio should be at least capable of accommodating the largest form in the school at once. Any additional space that can be provided will add much to its convenience. Where no storage-room is provided, a considerable provision must be made for shelves and cupboards, racks for drawing-boards, &c.

A piece of wood 2 or 3 in. wide let in flush with the plaster and carried round the room about 2 ft. above the dado, as suggested for class-rooms, should be provided, upon which to pin up drawings. A useful form of easel for school work is shown in Fig. 51.

52. A Studio for a Large Elementary Class.

A method of fitting up a studio for a large class doing elementary work is shown in Fig. 52.* This provides a slightly different view of the model for every pupil in the class.

* From the catalogue of the North of England School Furnishing Company.

Chapter VI.

SECONDARY DAY SCHOOL BUILDINGS

(Continued).

Cloak-rooms—Question of one large Cloak-room or separate Rooms for each Class—Pilfering in Cloak-rooms—Suggestions of a Headmaster—The American System, Examples of—The Manchester High School—The Blackheath High School—Space required for Cloak-rooms, Lockers, Stands, and Racks—Measurements of Stands—Material for Floor—Kindergarten Cloak-room—**The Principal's Room**—Position of, in reference to Secretary, Porter, &c.; to Entrances and to Hall—Accommodation for Inspectors and Examiners—**Dining-rooms,** Position in Basement or Top Floor—Sizes necessary for Tables—Distance apart, &c.—**The Kitchen** and its Position—Mid-morning Lunch in Girls' Schools—**Libraries** for Masters and for Pupils—Use of the Library in German Schools—**Sixth Form Rooms,** Arrangement of—Differences from an ordinary Class-room—**Museums,** their Position—Opinions on their Use—**Emergency Rooms** and Sick-rooms—Bath-rooms—Cleaning Rooms—**Music-rooms,** Size and Position—Methods of Sound Prevention—Practising and Teaching Rooms—Use of Class-rooms for Music Lessons—Play and Recreation Rooms, Size required for—**Kindergarten Schools** and their Arrangements—Desks, Tables, Chairs, &c.

CLOAK-ROOMS.

Cloak-room accommodation raises a number of debatable points, the most important of which is that of the relative advantage of having one large cloak-room with accommodation for the entire school, or whether it is better to have it in two or more separate places, or finally to have, as is commonly done in America, a separate cloak-room attached to each class-room.

The first plan is undoubtedly the pleasantest. All the wet clothes, &c., can be kept right out of the main part of the building; the place can be properly warmed and ventilated; a drying-room can probably be placed close by; and if the room is well planned, and stands well arranged, one mistress—for it is in Girls' Schools that the question of cloak-rooms is naturally of so much importance—can supervise the whole room. On the other hand, it is urged that when most of the school are dismissed together there is a great deal of crowding and confusion;

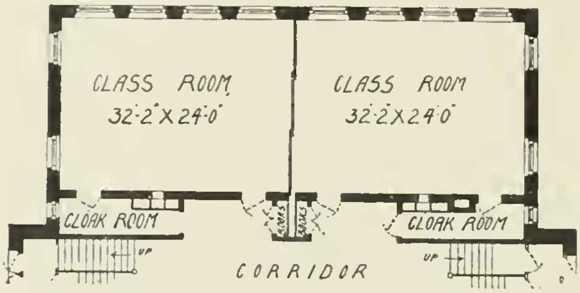
that it is not always possible to keep a proper watch upon it ; and that in this way it offers too many chances for one of the most annoying offences of school life, that of petty larceny. This is an offence in which detection is difficult, and one which, from the mutual suspicion and distrust aroused, and the unpleasantness and evils arising from the attempts made to discover the offenders, causes great trouble to Head Masters and Mistresses of schools ; so much so that they are generally willing to put up with a great deal of discomfort and unpleasantness, and the unsightly appearance generally attached to the arrangement of a cloak-room attached to each class-room, in order to make sure of an effectual supervision, which would render pilfering impossible. In large Day Schools where the pupils are drawn from very different classes of society, however good the tone of the school, there will be from time to time children who will be only too quick to avail themselves of any opportunities of the sort that may occur. A Headmaster,* writing on Secondary School planning, suggests that—

"The remedy is to abolish the central cloak-room altogether, and instead of it to attach a separate cloak-room, and put it in charge of the master who teaches in that room. It should be about 6 ft. wide, and should run the whole length of the class-room. It may be 9 ft. high, or it may be carried up the full height of the class-room. It should be separated from the class-room by a wooden screen, pierced with a continuous window, and the master should be so placed that he can command every part of it. It should be thoroughly well lighted by an external window, and be heated by hot-water pipes, so that wet coats may be dried. There should be two doors, both leading back into the class-room and not into a corridor or the hall."

This arrangement is carrying the system often adopted in America a step or two further (see below, Fig. 54), and, while perhaps possible in an Elementary School, would hardly be tolerated in the Secondary Schools of this country. Even if the assistant teachers did not object, there would be a considerable number of inconveniences attached : the unsightly appearance in the class-room ; the smell of clothes, especially in wet weather, which would inevitably come into the class-room ; the loss of space, which, as it is to be 6 ft. wide with an external window, must be taken off the aspect chosen for the class-rooms ; and finally, the almost hopeless confusion that would, under certain circumstances, ensue at the end of lesson time, especially if the school were at all full. In case of a class which spent the last

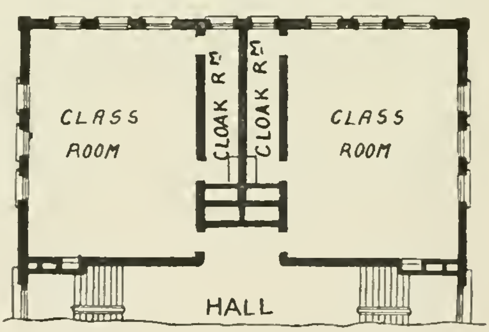
* *The Builder*, 4th January 1890.

hour in the studio or chemical laboratories, either the form master would have to be back in the empty class-room to see his class take their coats and hats (for the only entrances were to be from the class-room), or else it might happen that some division was being taken in the room, in which case the disturbance would be considerable. In a German School, where the classes are not reclassified or divided, it would no doubt be easy to manage some such plan, or in America, where this system is commonly found, where each pupil has his regular seat in one of the large school-rooms, but it would surely be difficult in a school organised on the lines of our Secondary Schools. The proposal, however, shows to what lengths the heads of schools are willing to go to obtain really effectual cloak-room supervision.



53. SHOWING CLOAK-ROOMS AS PASSAGES TO CLASS-ROOMS.

The American system of providing cloak-rooms in the form of passage-rooms to the class-rooms has not, as far as I am aware, been yet tried in this country. In that country the usual plan (see Fig. 53) is to have an entrance both to the cloak-room and the class-room, so that access can be gained to either one without necessarily going through the other. But in many cases the only access, as mentioned above, to the cloak-room is through the class-room itself (see Fig. 54). Sometimes, as in Fig. 368, there is a sort of cupboard each side of the door of the hall itself, or rather the wide corridor is cut up into small cloak-rooms (see Fig. 165), practically turning the hall into a cloak-room; but, whatever plan is followed, there is a separate cloak-room to each class.

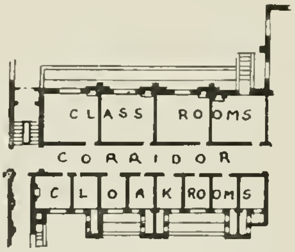


54. SHOWING CLOAK-ROOMS WITH THE ONLY ACCESS THROUGH THE CLASS-ROOMS. From an American School.

Mr Briggs, in "Modern American School Buildings," strongly advocates the use of partitioned hat and cloak rooms placed in the main hall of the building, suggesting further that the upper parts might

be wire-netted in order to make supervision more easy. It will often be noticed, on looking at plans of American Schools, that the greater part of the main hall is taken up with the cloak-room arrangements. There would be strong objection to any similar plan being adopted in this country, where every effort is made to keep the floor space of the assembly rooms or halls as free as possible.

At the Manchester High School for Girls there is an arrangement adopted after careful inspection of American plans, and after visits to a number of their schools (see Fig. 55), by which there is a double cloak-room arranged to every class-room, placed on the opposite side of a wide (18 ft.) corridor, each cloak-room also containing a water-closet disconnected from the building by a lobby. The accommodation allowed for cloak-rooms is on a lavish scale, and few schools would be now able to afford the expense of such a scheme. The doors leading into these rooms are cut off at a height of 3 ft. 6 in. to allow of supervision. The Headmistress, Miss Burstall, speaks very highly of the comfort and success of this arrangement. But the expense involved has probably prohibited its general adoption, and also perhaps the rather unsightly appearance in looking down the corridor; for though this school has been built some twenty years, it has not, to my knowledge, been tried in any other Girls' Schools, and certainly has not been adopted to any considerable extent.



55.

At the Blackheath High School for Girls the plan has been tried of a long cloak-room running along a corridor in the basement, divided into a number of small rooms corresponding to classes. This obviates some of the disadvantages in the way of crowding.

However, the plan most usually adopted now is to have one or two large rooms fitted up as cloak-rooms, as near the pupils' entrance as can be conveniently arranged, and, provided that sufficient outside window space can be given, there seems little objection to their being placed in the basement, while there are many advantages arising from such a position, for they occupy space that cannot well be used for any other purpose, and are kept well away from all the parts of the building used for school purposes.

As regards the space required, there is very much less given or required as a rule in Boys' Schools than in Girls'. In a great many Boys' Schools no regular cloak-room is to be found. At the Mercers' School in Holborn, rebuilt in 1894, boys are expected to use the

lockers, of which every boy has one, arranged in the corridors. These are of sufficient height to allow of pegs upon which coats can be hung, and umbrellas put inside, while providing a shelf above for books, &c. They are raised 3 in. from the floor. The bottom of the locker is perforated to allow wet umbrellas to drain into a channel arranged underneath, while a hot-water pipe runs through all the lockers. The same plan is in use at St Paul's, West Kensington. At Bedford Grammar School there are pegs for hats and caps in the small passages which lie between the class-rooms and the hall (see Fig. 71). Of course this is partly a Boarding School, and when the boys come from boarding-houses close to the main block of the school building they have probably only a cap, and not always that, to dispose of. This can usually find a refuge in the boy's pocket.

In the case of Girls' Schools much more elaborate arrangements are necessary. The cloak-room must not only provide room for the disposal of hats, coats, &c., but pigeon-holes or shelves must be provided for every girl attending the school, for the purpose of holding a pair of boots or shoes. Facilities must also be provided for the purpose of changing their boots, and it must be so arranged that they can do so in considerable numbers without confusion.

Dimensions for Cloak-rooms.—In fitting up a room for a cloak-room it is usual to have the fittings placed against the wall space as far as that is available, and to get the additional accommodation required by placing stands across the room. These would be arranged with a seat each side, separated by a screen with the necessary pegs on each side. The hooks or pegs should be at least 12 in. apart. The width of a stand with seats and pegs each side may be calculated at 18 in. These should not stand closer together than from 6 to 7 ft., to avoid disorder in moving about. At the ends of the stands which come opposite the wall there should be a clear space of from 4 ft. to 4 ft. 6 in. Taking these dimensions, it will be found that it is necessary to allow between 4 and 5 sq. ft. of cloak-room per pupil, the exact amount depending on the amount of wall space that can be devoted to fittings after allowing for windows, doors, &c. Of course where there is plenty of room it is a great advantage to allow a larger space. This will make supervision easier, and prove a great boon when a large number require to use the room at once.

At the Birmingham High School, where the cloak-rooms and lavatories are particularly spacious and well arranged, there is one large cloak-room measuring 68 by 30 ft., the number of the school

being 300 (see Fig. 132). The additional cloak-room accommodation required becomes often a serious problem in the case of additions to a school, a contingency which should not be lost sight of in the original scheme. In planning a cloak-room, great care should be taken to have no awkward corners, *i.e.*, it should be possible to see the whole room from one point. It should of course be well lit, and have means of thoroughly efficient ventilation. Hot-water pipes carried round the room and through the centre of each stand are usually provided to keep the clothes dry and well aired, though it is not well to rely upon this for drying things really wet, for which purpose there should be a regular drying-room arranged in connection with the heating apparatus. The boxes or pigeon-holes for boots should be raised from the floor, so that the whole floor can be easily washed. Arrangements of wire racks on which the boots are to be balanced do not work as a rule satisfactorily, the shoes and boots usually finding a resting-place on the floor.

In order that washing should be easy and quick, the floor should be of some non-absorbent materials, of which tiles are undoubtedly the best, both from the point of view of appearance and health. Unfortunately, they are rather expensive.

Cement, although making in many ways a good floor, is not suitable for schools, as it is easily kicked or rubbed off, making an unpleasant and deleterious dust. Wood blocks, though not drying so rapidly, are preferable. Asphalte seems inclined to wear rough and unevenly.

In speaking of cloak-rooms with reference to American Schools, Mr Shaw strongly advocates a special cloak-room to each class-room, and suggests that in fitting up a cloak-room the best plan is to have a shelf 15 in. wide supported on strong brackets right round the room 5 ft. from the floor, on the under side of which, about 15 in. apart, and about the middle of the shelf, double coat-hooks are screwed, thus ensuring a complete circulation of air about the clothing. They are blocked out from the wall to allow circulation of air, and curved in at the bottom so that the room may be easily swept.* The stands shown in Fig. 298 provide for a thorough circulation of air, while preventing the clothes from contact.

In schools where there is a Kindergarten there should be a separate cloak-room for that department in close connection with it, and also

* Cloak-rooms for Elementary Schools are further considered when dealing with the plans of such schools.

separate lavatory and necessary W.Cs. attached. When planning the Kindergarten cloak-room, it should be remembered that it is usual to send a nurse or maid to fetch the children, so that some convenient place may be arranged in which they can wait instead of a draughty corridor.

Lavatories and sanitary conveniences are treated together in the chapter dealing with sanitation.

PRINCIPAL'S ROOM.

The position of the Head Master's or Mistress's room is a matter requiring some consideration. It is usually found close to the main entrance, which is generally an excellent position for the purpose of visitors to the Headmaster. It should also be as near as can conveniently be managed to the platform end of the hall ; firstly, so that the Headmaster can gain his place on the platform with the least possible waste of time and trouble, and further, because in cases of functions of any kind it is usual for persons who are to occupy positions on the platform to collect in the Head Master's or Mistress's room. At the Mercers' School in Holborn the Headmaster has a door leading directly on to the platform from his room, and mentioned it as a particularly convenient arrangement (see Fig. 124). There should be in close connection with this room a Secretary's room and a small waiting-room, and also a lavatory and closet. In larger schools there will be also a Clerk's office connected with the Secretary's room. The Headmaster's room and Secretary's room should be in close connection, there being continual need for communication, either leading from one to the other, or, as is sometimes the case, having communication by a hatch or window. In small schools where space is an object, the Secretary's room has to serve for a waiting-room. The room for the Head Master or Mistress should not be too small, a mistake not infrequently made. It often happens that the Head Master or Mistress may wish to take a small class or division there. Where a Committee-room is provided, it is often conveniently put next the Secretary's room ; or it may serve for the Secretary's room, being only required for Committee or Board meetings at considerable intervals. There should of course be lavatories attached. In the plan of the City of London School (Fig. 112) a convenient arrangement is shown. It will be noticed that there is a small turret staircase leading from the Committee-room directly to the platform in the great hall. It is difficult to find any common plan for the arrangement of these rooms ; but usually, close to the main entrance of

the school, are found accommodation for the Headmaster, Secretary, Secretary's office, and the porter, and the more easy the communication the better. There is an additional consideration in the case of Girls' Schools which should not be lost sight of, and that is the accommodation for Examiners and Inspectors when visiting the school. In very large establishments there will no doubt be found separate accommodation provided, but in schools where in planning every square foot has to be zealously looked after it would not be possible to make provision for such an occasional need. Of course the waiting-room can well serve for this purpose, but, as the Examiners probably spend the day in the school, some provision should be made for their comfort. In case no space can be spared to provide a lavatory for the waiting-room, the most economical plan is probably to arrange that the Headmistress's room and the waiting-room should both open into the same lavatory, in which case, by locking one door or the other, it can be attached to either room as required.

The telephone-board, with an attachment to every part in the building, placed in the Headmaster's room, though occasionally useful, is probably rather more a theoretical than a practical advantage, as far as the class-rooms are concerned; but a speaking-tube to the kitchen or schoolkeeper and the Secretary's room, if the latter is not close by, is undoubtedly useful. When there is a complete system of tubes, the Head Master or Mistress is usually obliged, in self-defence, and to avoid continual disturbance, to have a rule that all calling up should originate at their end.

The Principal's room should, if possible, command the entrances to the school.

DINING-ROOMS.

A dining-room has as a rule to be provided in Day Schools. The number of pupils staying to dinner in the middle of the day will of course vary considerably according to the locality and other reasons. In some schools very elaborate dining arrangements have to be made, the greater part of the school staying to dinner. There are two ways of arranging the dining-rooms and kitchens. One, and perhaps the commonest, is to have the dining-room and kitchen in the basement; the other, to devote the top floor of the building to this purpose. There are many advantages in the latter plan, the chief of which is the absence of any chance of the smell getting into the school part of the building, since effectual ventilation is easy. And when expenditure in the building is of importance, it is possible to

provide a light and cheerful dining-room in the roof, where the slope of the ceiling would prevent its use for any other purpose.

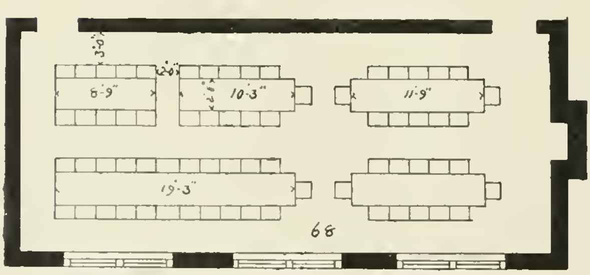
The Newcastle High School for Girls, recently erected by the Girls' Public Day School Company, has an arrangement of this sort with satisfactory results (see Fig. 126).

At St Paul's School, West Kensington, where over 200 boys dine every day, there are most complete and excellent arrangements (see Fig. 119), also placed on the top floor.

In order to calculate the amount of space that is required per head for the dining-room, the important point is the space taken by the table, and the distance between the tables necessary to allow of sufficient space for waiting. The amount of cubic space is of less importance, provided that the room can be thoroughly aired, as it is occupied for so short a time, but not less than 10 sq. ft. of floor space should be provided.

The Size of Tables, &c.—The following short table gives the dimensions which may be taken to give sufficient room :—

	Ft.	In.
Width of table - - - - - -	2	8
Width of one place - - - - -	1	9
Depth of one place - - - - -	1	4
Distance between backs of seats of two adjacent tables	2	6
Distance from wall to back of seat - - -	3	0
Distance between the ends of two adjacent tables -	2	0



56. Various Arrangements for Dining-room Tables.

In Fig. 56 is shown a plan illustrating different ways of arranging the tables and seats. Where a seat has been placed at the end of the table, a space of 1 ft. 6 in. has been left. In the case of a table wider than 2 ft. 8 in. this could be dispensed with and the side seats brought up to the end. This should be considered the minimum allowance of space to ensure a comfortable room.

The kitchen and dining-room are on the top floor in the Birmingham High School for Girls, and, as the demonstration-room is close by, they can thus be made use of in the cookery instruction

if required (see Fig. 137). A Headmaster, writing in *The Builder*,* describes the dining-hall at the Ecole Monge in Paris. The boys ate at little marble tables. As soon as they had finished, a relay of servants carried off plates and dishes; the windows were thrown wide open; a mighty hydrant was opened, and a deluge was sent flying over tables, floor, and walls; and, in a moment, crusts, crumbs, smells, and foul air disappeared in one gush. The windows were closed, heat turned on, and soon the hall was ready for another batch of diners.

It is hardly necessary to lay stress on the point that the kitchen should be in close connection with the dining-room, with a hatch making perhaps the best arrangement. Whatever scheme be adopted for the kitchen and offices, it is of the greatest importance that they should be thoroughly cut off from the rest of the school building.

Mid-morning Lunch.—In Girls' Schools it is usual for the girls to have some slight refreshment in the middle of the morning, taking as a rule the form of a glass of milk and a bun. A hatch with a fair amount of space round will serve the purpose well, and obviate any tendency to crushing and confusion. The large kitchens required in Boarding Schools are more fully dealt with when considering the subject of those sort of schools.

THE LIBRARY.

It is becoming more and more recognised that a library is a very necessary adjunct to a school, not so much in its older form, which consisted of a collection of books, often very valuable, put in a room, to which no one except perhaps one or two of the masters ever went, but a library to be used continually by the upper parts of the school, containing all the books of reference that are likely to be wanted, and the books so selected that it can be thrown open to the school, or rather to such part of it as may be considered advisable; for there is little use in the younger part of the school having access to a room intended for quiet study, and containing books for reference, not for light reading. This want should be otherwise and fully provided for. The chief use of the school library is to enable those in the higher forms of the school to learn to use books for themselves, without being told exactly where to look for anything. This of course applies with equal force to Girls' Schools, where it is becoming more and more the custom to allow the sixth form to use the library as a room for working

* *The Builder*, 4th January 1890.

in when doing individual and private work. There should be also a teachers' library. In German Schools it is almost invariable to find the two libraries—one for the school, the other for the teachers. Of course, when two rooms cannot be provided, there may be certain cases reserved in the general library; but the great point is that the library should be regarded as a room to be used. Where it is not possible to provide a separate room for the library, it may be possible to fit up a room otherwise used with the necessary shelves.

The sixth form room at a pinch will serve for the library, as these are the pupils who will chiefly use it. The Headmistress's room sometimes serves for the purpose, but this is open to the objection that it is apt to interfere with the pupils having the free use of it. As regards the other sort of library—that of fiction and books for recreation and pleasure—while it is perhaps of little less importance that there should be a good supply of the best books of this sort, and that the boys and girls of every age should be induced to read them, the position of their accommodation in the school premises is not of much importance, wherever bookcases or shelves can be conveniently put up. The dining-room will often provide a good deal of wall space.

Sixth Form Room.—It is usual in Girls' Schools as well as in Boys' Schools to have what is known as a sixth form room. In order to keep up the idea of the difference in status acquired by those who have reached the dignity of the sixth form, and as it were to mark them off a little from the rest of the school, and perhaps to add to their feeling of responsibility, and to a certain extent to their authority, this room is fitted up differently to a class-room. Work is probably done at a large table with chairs instead of the usual desks; it is more carefully looked after, and begins to take on more the air of a sitting-room than a class-room, with jealously regarded privileges. However badly warmed, lit, or ventilated, it is a delicate matter to touch this room, or suggest changing to another, however much better the new one may be in every way: more especially if the school is an old one, there are associations and memories attached to the old room with which it is an invidious task to interfere. In building a new school the sixth form room should if possible be arranged to be a pleasant and comfortable room, and need not necessarily be on the pattern of the other class-rooms.

Museum.—A special room to be used as a museum is found as a rule only in large schools, and is of course a most valuable adjunct to the school; but it is probably only in the great Boarding Schools where

museums of any size are found. But it may often be worth while when planning a school, if a museum cannot be provided, yet to allow space in some corner or corridor where cases for specimens or cabinets can be conveniently placed. There is some diversity of opinion as to the value of museums in schools. Some Headmasters, who think that their real value lies in the collecting, even go so far as to recommend that all the contents should be thrown away at the end of the year. This of course can only refer to collections of flowers, stones, &c., which are made by the school in its immediate neighbourhood. But unless there is some master or mistress who will take an energetic and continual interest in it, a museum is apt to degenerate into a rather forlorn and miserable place, and the room given to it could, except in large buildings, be probably better utilised for other purposes. There is an interesting account, illustrated with plans, of a school museum, in the second volume of the "Special Reports" issued by the Board of Education.

Emergency Rooms.—There should be in every Day School at least one emergency room, or a room in which any boy or girl who is unwell can lie down in quiet, or where any pupil who comes to school and being unwell is suspected of having some contagious disease, such as measles and scarlatina, &c., can be isolated. It should be placed as far as possible out of the way, both for isolation and in order that it may be quiet and undisturbed. A lavatory attached is of course an advantage.

Bath-rooms.—A bath-room is sometimes provided. For example, in the Birmingham High School there is one, and the Headmistress, Miss Creak, mentioned it as being very useful on certain occasions. I gathered it was used chiefly for remedial purposes, in such cases as girls being overcome by the heat, and sometimes also when they had driven long distances to school in very cold weather. On the whole it seemed that it was not very often that it was wanted, but that on occasion it had been of great service.

Service-rooms.—Cleaning-rooms for brushes, &c., with hot and cold water laid on, should be always placed on each floor in some convenient position. The lack of this precaution is the cause of a good deal of the trouble that sometimes arises with school keepers and cleaners of school buildings.

Music-rooms.—Music-rooms have to be placed as far as possible where the sound will cause least disturbance. The usual plan in Girls'

Schools—they are not always supplied in Day Schools for Boys—is to have a line of them placed together, allowing as a rule two to every 100 girls. The size should not be less than 8 by 10 ft., nor is there much to be gained by their being larger, provided there is sufficient room for the piano, pupil, and teacher. They should of course be warmed. For teaching singing, a room twice the size at least is necessary. The usual plan to prevent the interference of the sound between the adjoining rooms is to make the walls hollow and packed with some material adapted to stop the passage of sound as far as possible, asbestos, &c., and to provide double doors. It is worth remembering that neither the joists, and more especially the floor boards, should continue from one room to another. I have more than once seen a row of two or more music-rooms where the most elaborate precautions to stop the sound had been taken with the walls and doors, but which were entirely nullified by the floor boards, which were continuous. It is not unusual in Girls' Schools, where the expenses are to be cut down, to provide no music-rooms, on the ground that the pianos can be put in the class-rooms, since these rooms are not as a rule used in the afternoon in such schools. This plan will be found to cause a great deal of inconvenience, and to be objected to strongly by both the Headmistress and by the music teacher, owing to the constant interruptions caused by pupils coming in for books and things left behind, &c., or their having to be turned out because the room is required for some purpose. In Boarding Schools * a rather larger number of music-rooms are required for the purpose of practising.

Play-room.—Though this can hardly be considered an absolute necessity in a school, it is of the greatest advantage to have some such room where it is lawful to make a noise during the recess between lessons in wet weather. A room of this sort is almost invariably found in America, even in the Elementary Schools. It is not uncommon to find in Secondary Schools in this country a covered playground in the basement, of the same size and immediately under the hall. Of course where there is a gymnasium in the school it will perfectly well do for this purpose. At the Birmingham High School (see Fig. 137) there is a play-room provided on the top floor. This is the more necessary as the building is not only a very high one, but there is no playground owing to the restricted nature of the site. A space of 5 or 6 sq. ft. per pupil should be provided if possible.

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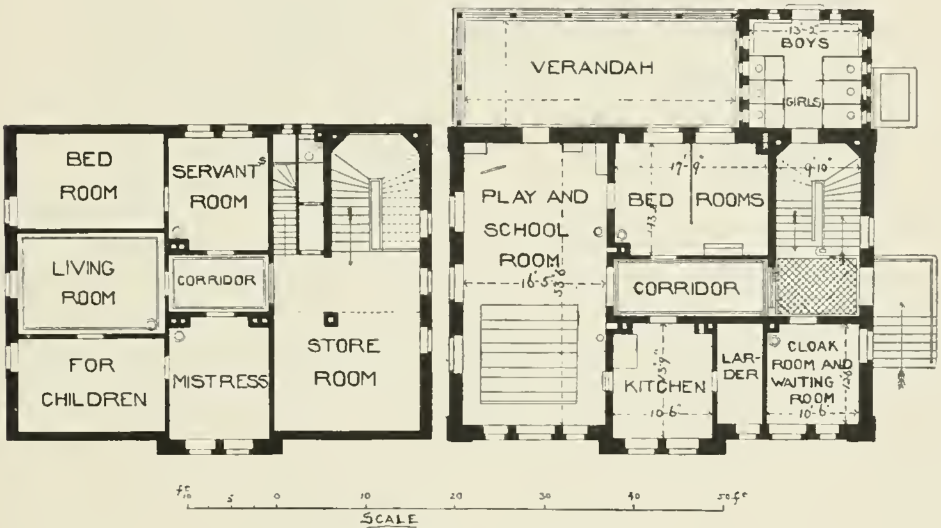
* See below, page 205.

Kindergarten Rooms.—Where the Kindergarten is merely an adjunct to a school, as is so often the case in Girls' Schools, there is little else required for the purpose than a large, well-lighted, cheerful room, with its separate cloak-room and offices. In providing the lavatory accommodation, it should be remembered that there are usually boys as well as girls to be provided for. The room itself should be of ample size, and face south or south-east in order to ensure plenty of sun in the mornings. The sills to the windows should also be kept low. This room is not as a rule used in the afternoon, except when there are student-teachers attached to the Kindergarten for the purpose of training. The ground floor should always be the position for this room in order



57. A KINDERGARTEN SCHOOL.

Reinold Faber, Architect.

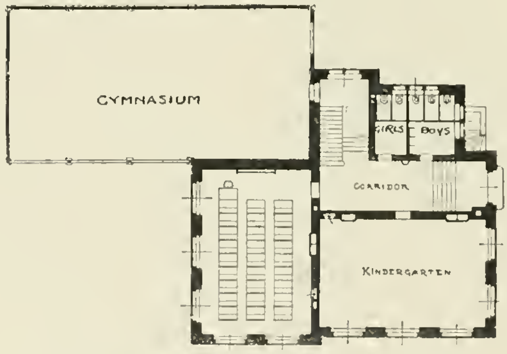
to avoid stairs, and it should be placed next the class-room, which is devoted to the transition form, or first form, if the former be taken in the Kindergarten room. This class-room may very conveniently be made rather large and divisible by a movable partition, as the transition form is classified with first one and then the other. Where the numbers in the Kindergarten are considerable, or where the Kindergarten is a school by itself, it is necessary to have a certain number of class-rooms. These need not be large, as the classes are not likely to consist of more than 10 or 12, but there must be either a hall or a room large enough to allow plenty of space for the marching and games which play so large a part in a Kindergarten training.

In Germany it is usual to supply living-rooms for the Kindergarten

teacher in the building. Hinträger * gives the following list of rooms for a Kindergarten :—(1) Employment room ; (2) playroom ; (3) cloak-room ; (4) office ; (5) living-rooms ; (6) sanitary conveniences ; (7) play-ground and gardens.

58. KINDERGARTEN SCHOOL, ZÜRICH.
A. Geiser, Architect.

The gardens are considered an important part of the school. They should be shaded by trees, and provide not less than 3 sq. metres (30 sq. ft.) per head, and the whole in no case less than 1,500 sq. ft.† According to one writer, the garden should be of large size, and contain arbours for working in, aviaries, a labyrinth, a maze, heaps of sand, little gardens for the children, ponds and fountains.‡



59. KINDERGARTEN SCHOOL, ZÜRICH.

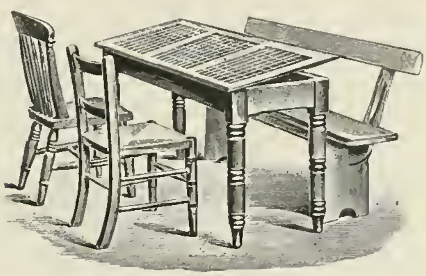
Fig. 57 shows the plan of a small Kindergarten School. This is intended to take in children as boarders. The verandah makes an excellent place for marching and playing in warm weather.

* Bau und Einrichtung von Pflege- und Erziehungsanstalten für die Jugend des Vorschulpflichtigen Alters, Hinträger.

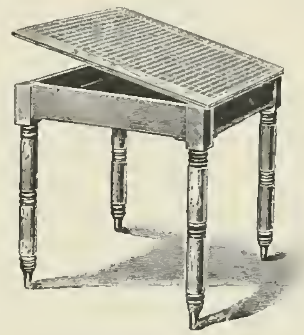
† Schulhygiene, Baginsky. ‡ Mutter- und Kindergartenbuch, Georgens.

Figs. 58 and 59 show the exterior view and ground plan of a Kindergarten School at Zürich.

The furniture of a Kindergarten room should be light and easily movable. For the older of the children desks of the ordinary type are made, but usually with flat tops marked in squares. The smaller children usually sit on small chairs at low tables, also marked in squares (see Fig. 60). Those with rounded backs are found the most satisfactory and most comfortable for the children. The teacher is supplied



60. Tables and Chairs in a Kindergarten.



61. Teacher's Table.

with a table marked similarly with small squares, and arranged with a top that can be raised (see Fig. 61) in order to make the surface visible to the class in front.

There is so much apparatus used in Kindergarten teaching that plenty of cupboard room must be supplied, as well as shelves for the pots of flowers, aquariums, &c., that have to find a place. It is as well to provide wooden rails round the room on which drawings can be pinned up.*

* See page 74.

Chapter VII.

SECONDARY DAY SCHOOLS.

PLANS AND DESCRIPTIONS OF SCHOOLS.

Questions as to what constitute a Good Plan—Test of a Well-planned School—Plans from the point of view of the Headmaster—Remarks of a Headmaster on School Planning—Girls' Schools and Boys' Schools—Types of Plans—The Central Hall System, Advantages and Disadvantages summed up—Modifications of the Central Hall System—Examples of Schools—Colet House School—The Bedford Grammar School—University College School—Streatham Hill High School—The Sheffield High School—Brentwood School—Aske's School for Girls, Acton—The Victoria High School, Stockton-on-Tees—The Hulme Grammar School—Hymer's College, Hull—The Wimbledon High School—The City of London School—The Lincoln Grammar School—St Paul's School, West Kensington—The Mercers' School, Holborn—The Central High School, Newcastle—School for 250 Boys—The High School for Girls, Birmingham—The High School for Girls, Manchester—The Farnham Grammar School—The Judd Commercial School—A Realschule—The XII. Realschule, Berlin—Die Augustinerschule, Hesse—Gymnasium at Aachen—Secondary School, Zürich—The Brighton High School, U.S.A.—The Groton School.

The different rooms and various component parts that go to make up a school having been considered in detail in regard to their numbers, requirements, &c., it is now proposed to consider the arrangement of the buildings, and the various methods adopted in combining them to form a school; but before proceeding to describe and illustrate the various types of school buildings, it will be as well to consider shortly what are the essential points that go to make up a good plan. Matters directly affecting the health of the scholars, such as questions of light, air, &c., are not here referred to. A school may be admirably lighted and fitted with every means that science or experience can suggest for its perfect heating and ventilation, and yet be badly planned. The point now referred to is that of the adaptation of the plan to the organisation of the school, and how far it assists to make the working of it efficient, easy, and economical; how much the wear and tear is reduced for the Head Master or Mistress; how much time is saved or wasted, in classes changing their rooms, for the Principal

in going his rounds; to what extent or with how little trouble can he know or find out what is going on in any particular place, or supervise the school during general movements; how many extra masters or mistresses are required on duty during recreation, or in the cloak-rooms during the assembling or dismissal of the school; whether elaborate sets of staircase or corridor rules are necessary to avoid disturbance or crushing, fruitful opportunities for which are provided by ill-designed corners, awkwardly situated doors, or narrow and dark places. The ideal plan arranges matters in such a way that all parts are so well lit and so easily supervised that there is no excuse for disorder, and no need for rules.

The cost of maintenance, too, will be materially increased or decreased according to the compactness and suitability of the plan or the reverse, but the chief importance of careful arrangement in this connection is rather to help the Head Master or Mistress in providing for the effectual discipline of the school. If the school is small, or if the Headmaster spends all his time at work in his own class-room teaching, or coaching a few brilliant boys in the top form, regardless of what is going on in the rest of the school, it is not of much use to take careful precautions to provide for easy supervision, or facilities for inspection, &c. This state of things, however, is becoming exceptional, and according to the custom prevailing now it is usual for the Head Master or Mistress to do little or no regular teaching themselves, but to devote all their time to directing and supervising the work of the whole school; though perhaps taking every form, some time or other, to make sure that the work is going on properly. In the Continental Schools it is, and has for a long time been, quite exceptional to find the Headmaster teaching at all. It is significant of this that his title is not Headmaster but "Director." Not only has the Head Master or Mistress to keep an eye on and be responsible for the general discipline of the school during out-of-school hours, but it is very necessary that there should be some means whereby information can be easily obtained as to how matters are going on during school hours in the different class-rooms, either that an eye may be kept upon a new and untried assistant, or to see generally what is being done. This should be possible without causing disturbance to the class by entering the room. A common practice is to have the upper panels of the doors of clear glass, and, while this is still strongly objected to in many schools, it is now frequently found, and undoubtedly has many advantages. But even without this, in the cases of

schools planned with a central hall, a Headmaster standing in the hall can as a rule locate any undue disturbance. These remarks on discipline and supervision hardly apply to what are known as the old Public Schools, where as a rule the class-rooms and boarding-houses are widely scattered about, and in different buildings, the school often being an aggregate of buildings built at different times as required. The school discipline itself, too, is to a large extent in the hands of the boys themselves.

The following remarks by a Headmaster of a Secondary Day School describe some of the difficulties to be contended with :—

"So long, indeed, as the boys are shut up in their respective class-rooms, the assistant masters are mainly responsible for discipline. But when the school is assembled together, *e.g.*, at prayers, or when all the boys are entering the building or leaving it, then the Headmaster is mainly responsible. Also when the classes are redistributed at the change of lessons, when boys are passing about for various reasons, it is the Headmaster with his porter or discipline master who is responsible. If you wish to make his task of supervision difficult, then build all the class-rooms in a line as at Reading School, so that the boys may have far to go in changing classes; and you may connect the class-rooms with a long echoing corridor, convenient for a stampede, for hustling, for running races. Narrow corridors especially facilitate hustling. Also sharp turns in a corridor will bring classes into sudden collision and riot at change of lessons. Nor will it be possible to detect the ringleaders if the corridor is dark. Moreover, a good deal of quiet bullying may be done in a dark corridor. While the Headmaster is in one corridor the riot can be started in another. Also if the Headmaster's private room is properly sequestered, the boys can be noisy with safety." *

As the chief object of supervision is to guard against disorder or bullying, it is of great importance that every corner of the playground and out-buildings should be easily visible from the Headmaster's room or the assistant masters' common room. The entrances and exits should be under observation. This can well be done by the porter if his room be well placed.

The differences between Girls' and Boys' Schools are small, and what there are, are more in matters of detail than in general arrangement, and, as far as the general organisation of the school

* A Paper on the Planning of Secondary Day Schools, by a Headmaster. *The Builder*, 4th January 1890.

is concerned, Girls' Schools are approximating more and more to that of Boys' Schools. In the large Public Day School the same subjects are taught on the same methods. Classification, distribution of classes, &c., and naturally the questions of lighting, warming, and ventilation, are the same for both, so that the two are here treated together, reference being made to any features that are peculiar to either.

Types of Plan.—There are, roughly speaking, two types of plan in large Secondary Day Schools. (1) Those with a central

62. THE ASSEMBLY HALL, BLACKHEATH HIGH SCHOOL.

The Girls' Public Day School Company. *E. R. Robson, Architect.*

hall into which the class-rooms open directly. (2) Those with class-rooms opening off a corridor, with the hall at one end of this corridor, or in some other convenient place, but separate from the class-rooms.

The former method, *i.e.*, the central hall system, is rapidly gaining favour as the best method of school planning.

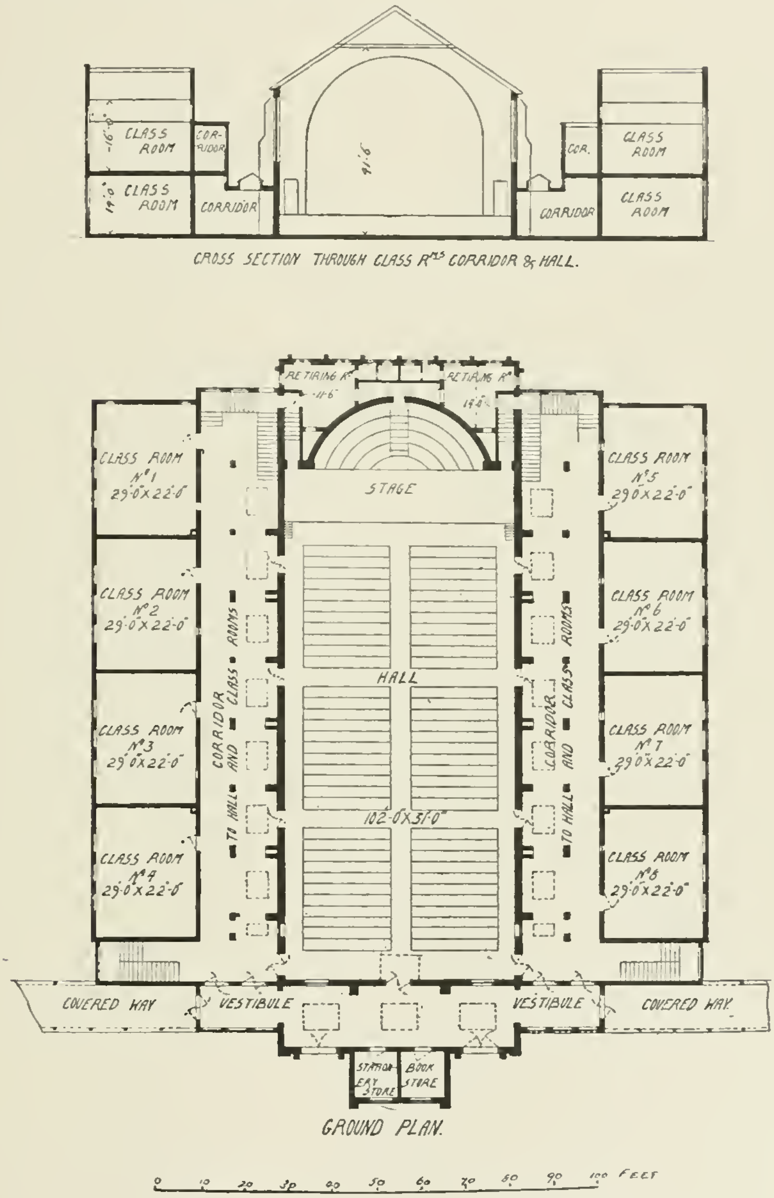
The advantages of the arrangement may be briefly summed up. The central hall provides the greatest possible economy of space by dispensing with corridors and passages, which in the other type

of plan have to be supplied in addition to the necessary space for the assembly room.

The main use of the hall being for the purpose of rapidly gathering the whole school together for prayers at the opening of school, &c., and then dismissing them to their respective class-rooms, it is essential that it should be easy of access. By arranging that all the class-rooms should open directly into the hall, this access is provided with the minimum loss of room. Supervision during movements of the school is reduced to its simplest form. The Headmaster from his position on the platform can command the door of nearly every class-room. There can be almost any number of rooms so arranged. For instance, at Bedford Grammar School (Fig. 70) there are nearly thirty class-rooms opening off the hall, arranged on three floors by means of galleries. During school hours the Headmaster is always right in the middle of everything, and if, as is usually the case, the upper parts of the class-room doors are glazed, he is able by merely walking round to command the whole work of the school. In fact, when the central hall can be kept principally if not entirely for the purpose of assembling the whole school when required, and of acting as a passage-room, it seems difficult to see how this plan can be much improved upon. But it often happens that the hall has to serve a number of purposes—(1) Prayers in the morning; (2) for the collecting of the whole school for an address by the Headmaster, or for some social function, such as prize-giving, &c.; (3) during wet weather in schools where no covered play-room or ground is provided it has to serve as a sort of recreation-room during intervals; (4) where there is no gymnasium, the apparatus for gymnastics has often to be fixed in it—drilling under instruction, dumb-bell exercises, &c., are there carried on; (5) for examinations, for special classes, or small divisions doing particular work, or part of a split-up form that can find no class-room vacant.

When the hall has to serve these different and almost contradictory purposes the question becomes more complicated, and the advantages of the plan more open to question. For instance, if an examination be going on in the hall the changing of classes is obviously disturbing when the latter acts as a passage-room, and a drilling class can hardly be carried on in the hall with sufficient absence of noise to avoid disturbing the adjacent class-rooms; indeed, should the latter be glazed, a drilling or gymnastic class offers a strong counter-attraction to the work inside. On the whole, however, though there are drawbacks under such circumstances, the plan

has so many strong points in its favour that heads of schools are almost unanimous in its favour when once they have tried it. For instance, a Headmaster writes :—

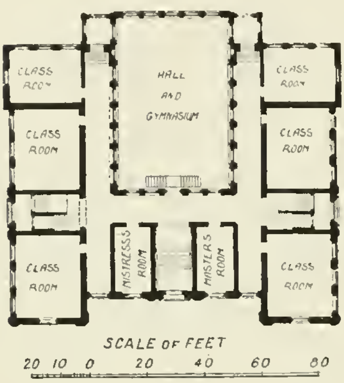


63, 64. Plan showing Method of Separating Class-rooms from a Central Hall.
Basil Champneys, Architect.

"I can conceive of no greater happiness for a disciplinarian than to be able from his own room to see every boy who enters

or leaves a class-room. That is what the central hall comes to. There should be a continuous window, about 5 ft. from the ground, running along the side of the class-room which is next to the hall, so that the Headmaster as he goes round can see the state of discipline in each room without entering the room and disturbing the class at its work. Not that he wants to play the spy on his staff, but that he may easily see what are the classes where his assistance and presence is required by a weak disciplinarian or by some master newly appointed in need of help."*

An interesting testimony in favour of the central hall is given by Mr Robins in a letter to him from Miss Buss in reference to the new buildings for the North London Collegiate School: "During the time that we have had the use of the hall we have found it exceedingly pleasant. The opening of the class-rooms directly out of the hall is certainly a great advantage. The supervision is much more easy, as is the control of pupils while assembling and dismissing. The light and ventilation are excellent, far better and more complete than they would have been if you had given us a passage." †



65.
A German Central Hall.

Various devices have been resorted to in order to preserve the advantages of the central hall while obviating the disturbance caused by its use as a passage-room. For example, at Bedford Grammar School, by means of partitions, proposed, I believe, by the present Headmaster when the plans were under consideration, there are passages so arranged that, while every class has direct access into the hall, there is an alternative route provided by which it is still possible to empty all the class-rooms without making use of the hall (see Fig. 70). Sometimes a corridor is taken round the hall between it and the class-rooms, in order to prevent disturbance by noise (see Fig. 64, taken from a competition plan by Mr Basil Champneys). This plan has many advantages, though of course it means a considerable waste of space, and, though preserving the quickness of access, makes the supervision less complete. In Fig. 65 is shown an arrangement of a German School where a somewhat similar plan has been adopted.

* The Planning of Secondary Day Schools, by a Headmaster. *The Builder*, 4th January 1890.

† Technical School and College Building, p. 206, E. C. Robins.

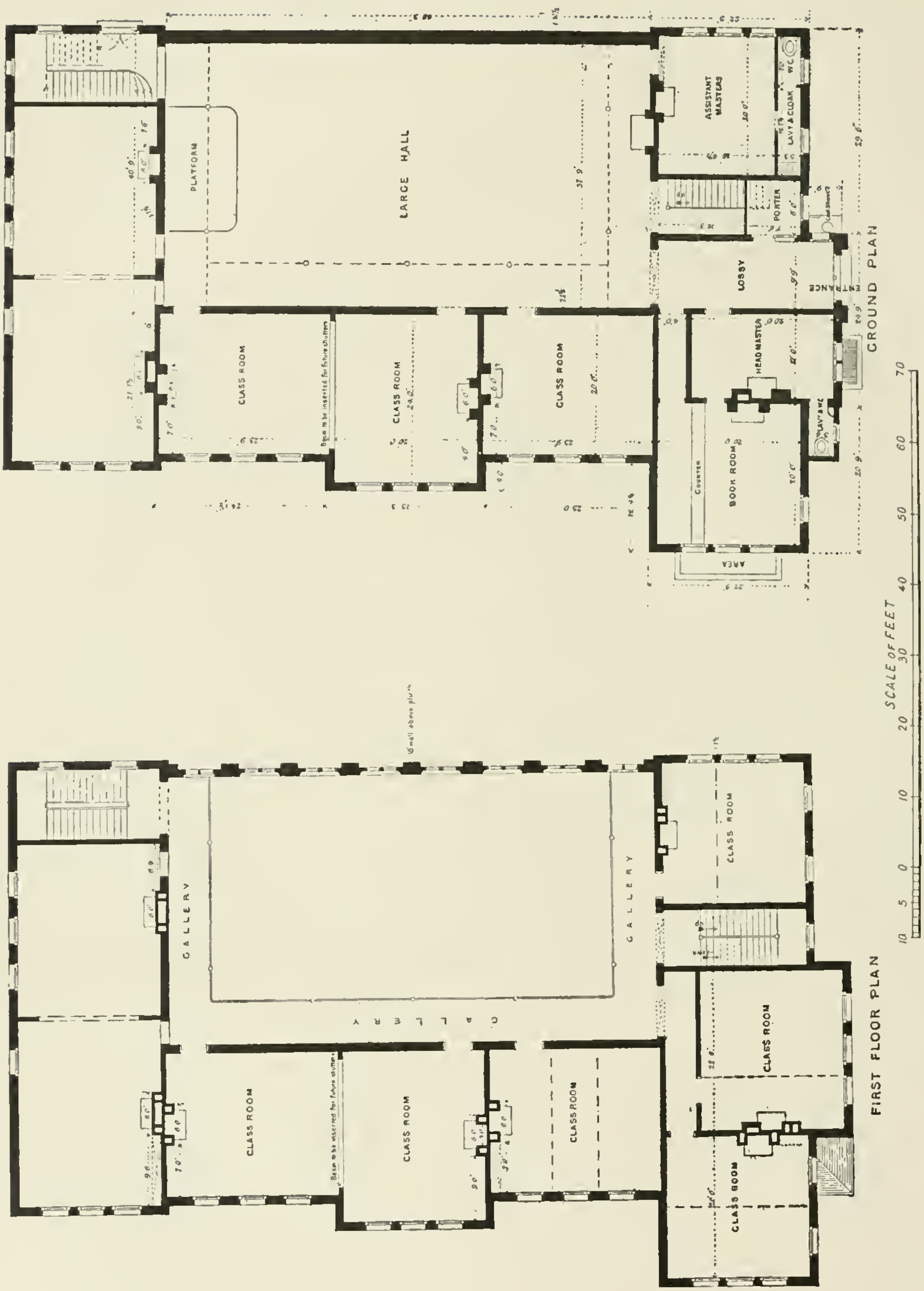
Various modifications of this scheme have been tried. For instance, at the Sheffield High School for Girls of the Girls' Public Day School Company the hall is arranged with a corridor along its inner side (see Fig. 91). In this way it is possible to have class-rooms on three sides of the hall without their actually opening into it. This particular plan has proved very satisfactory in use. A passage down the side of the hall formed by an arcade open to the hall, as for example at Hymer's College, Hull (see Fig. 108), or the Mercers' School, Holborn (Fig. 123), is often found convenient, as it gives the extra floor space to the hall, while leaving the main part of it unaffected by persons passing through.

There are of course many different ways of arranging the class-rooms with the hall. They may be placed all round, on three sides, or on two sides, as may happen to work in most conveniently with the arrangement of the building and the aspect of the site. The arrangement that seems most popular and widely used at the present time is that in which the hall or assembly room is placed on the north side of the building, and lit from that direction, the class-rooms, &c., being placed on the other three sides.

The examples which are given below will, it is hoped, show most of the different types usually found.

EXAMPLES OF SECONDARY DAY SCHOOLS.

Colet House School.—This school was opened in 1890 as a Preparatory Department to St Paul's School, West Kensington, close to which it stands. The building is an excellent example of the central hall system in its simplest form, consisting of nothing but the hall and its class-rooms, with the addition of a Headmaster's room and office, and an assistant masters' room. The building, which is intended to take 400 scholars, has a hall measuring 69 by 38 ft., off which open the class-rooms, there being galleries on the first and second floor for the purpose of access to the rooms above. A staircase at each end of the building enables the whole school to assemble in the hall and return to their rooms with the least possible loss of time or chance of disorder. It is reckoned that in case of alarm the 400 pupils, if seated at work in the class-rooms, could be all out in the playground in half a minute. This plan, although apparently so simple and straightforward, is the result of great care and experience, and is essentially what might be called a Headmaster's plan. There is not

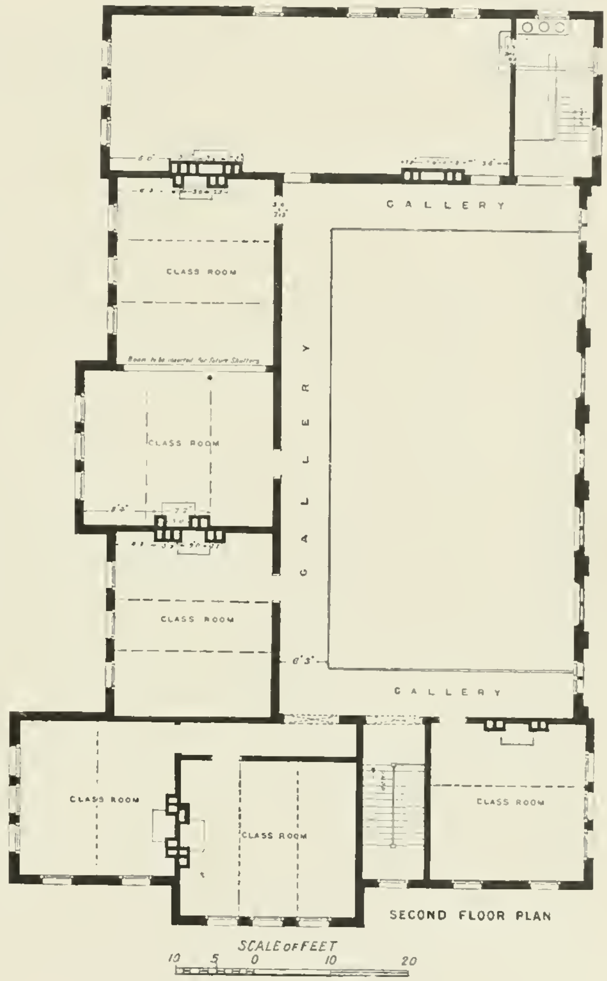


66, 67. Colet House School, West Kensington.

W. H. Spaull, Architect.

a corridor or passage in the building, and the Headmaster when in the central hall has command of the door to every room in the building except his own.

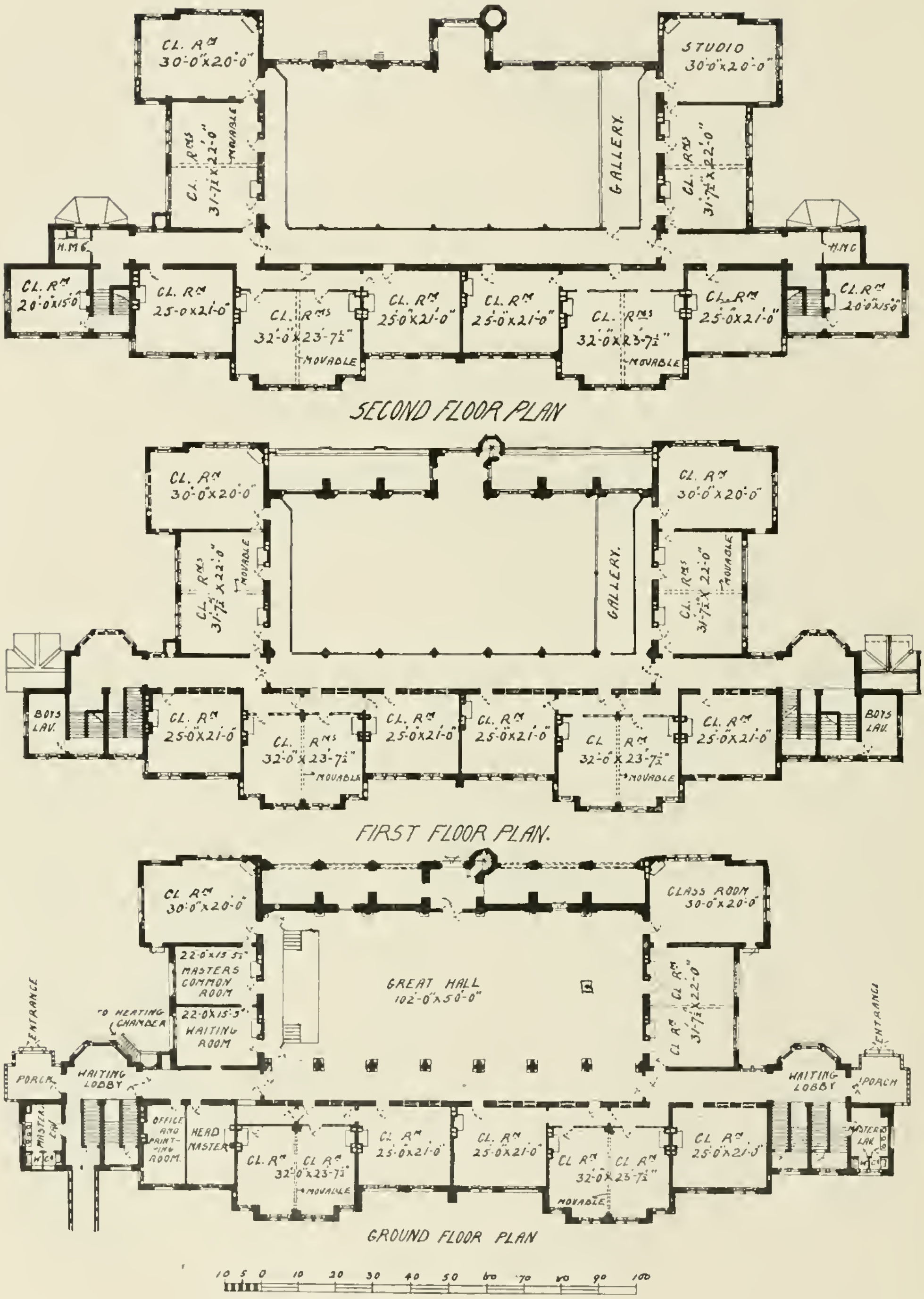
The school is heated by open fires, supplemented in the hall by hot-water apparatus. A Boyle outlet ventilator is fixed in each class-room. The offices stand away from the building in the playground. It will be noticed that there is no provision for cloak-room accommodation, or of hand basins for the boys. A certain number who live in the boarding-house * in connection with the school, and situated close by, do not of course require anything of the kind; but as these do not number more than 60, it would seem as though some accommodation should be provided for the larger proportion of the school.



68. Colet House School.

The Bedford Grammar School.—This building is arranged on a somewhat similar plan to the foregoing example, but on a much larger scale. It will be seen on referring to the plans (Fig. 71) that the building consists of thirty class-rooms, every one of which has direct access into the hall, round which they are arranged. The class-rooms are of two sizes, the larger ones capable of accommodating 40 pupils, the smaller about 30, allowing 16 sq. ft. per pupil.

* Described and illustrated *post*, see pages 237 and 238.



69-71. The Bedford Grammar School.

The Harpur Trust. *E. C. Robins, Architect.*

72. THE BEDFORD GRAMMAR SCHOOL.

From a photograph by J. Thomson, Bedford.

E. C. Robins, Architect.

In addition to the studio there are sixteen of the larger class-rooms for 40, and thirteen of the smaller for 20, the actual seating accommodation being 1,030; but of course it would be quite impossible to work the school with anything like this number.* There are in the school at the present time about 800 boys, which is probably quite as many as could be conveniently managed in the building. It will be seen on reference to the plan, that though all the class-rooms have a direct access into the hall, it is at the same time possible for the entire school to get out if the doors of the hall were locked and without passing through other class-rooms, except in the case of the rooms at the north-west and north-east corners of the building. This gives great power of quickly emptying the building in case of necessity.

The three floors are as far as possible arranged to correspond with the three departments of the school, the older boys being on the bottom and the Junior Department on the top floor. The three tiers of class-rooms correspond exactly, having the same numbers on each floor, while the particular floor is denoted by a letter. Thus any boy can at once tell where his class-room is or find any particular one without hesitation. The large galleries on each floor are used when the school assembles in the hall, as far as their capacity will allow, to accommodate the boys from the floor to which they belong. This saves a great deal of unnecessary movement, and, as the entire school assembles twice a day in the great hall for prayers, every gain in speed of movement and economy of time becomes of great importance. The staircases are well placed at each end of the building, and doubled as far as the first floor, discharging, as has been mentioned already,† into a corridor 8 ft. wide, increased opposite the stairs by a large bay window, which provides a convenient backwater or waiting place when two lots of boys meet. The boys' entrance is at the east end of the building, the door of which, however, faces north. It was found in cold weather with a north-east or north wind that very strong and unpleasant draughts were caused while the doors were open, in the hall and up the stairs. In order to obviate this, Dr Philpotts, by doing away with a small extra lavatory for the use of the assistant masters——there being besides sufficient accommodation for them near their common room—was able to make an extra entrance on the south side, so that in certain winds the doors on the north are closed, and those

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* See page 35. † See page 48.

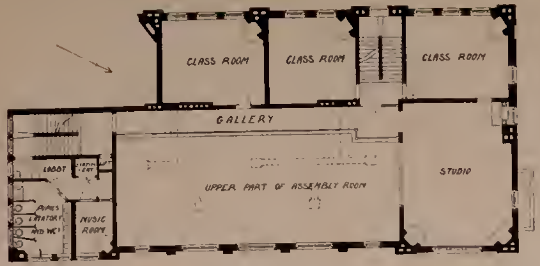
on the south used instead.* This alternative arrangement might well be borne in mind when planning a new building.

Every class-room has a ventilating grate in addition to the warming apparatus—Boyd's Hygiastic stoves being in use in the class-rooms—hopper ventilators over the doors and a fresh air inlet to every class-room, the air for all of which is taken from the south side of the building. The Headmaster spoke warmly in favour of the general scheme and arrangement of the building. Standing on the platform at the end of the great hall, practically the entire school is under his eye; the building is extraordinarily compact, and any point in it can be reached in a few minutes. The other rooms necessary to a school, such as physical and chemical laboratories, &c., are in a separate building; and as it is to a great extent a Boarding School—those who are not boarders live close by in the town or are attached to a boarding-house—there is no need for any provision for cloak-rooms, lockers, dining-rooms, &c.

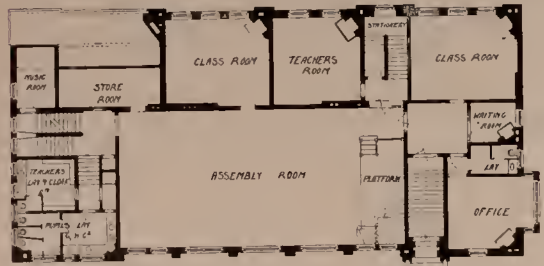
University College School.—As a further example of a large school arranged with the class-rooms all opening off a central hall, the new buildings about to be erected at Hampstead by Mr Arnold Mitchell will serve as an excellent example. It will be seen on looking at the plan, Figs. 73 and 74, that the general scheme consists of a centre block with two wings connected by a covered way; in these are placed on one side the cloak-rooms for the senior boys, a gymnasium, and over a dining-hall, in the corresponding wing on the other side, are cloak-rooms for the junior boys, the rest of the building being occupied by the rooms for science teaching. It should be pointed out that the plans show the school as originally planned. They have been subsequently modified by a large increase in the size of the wings, by which the gymnasium and dining-hall have been nearly doubled in size, as has also the science block. The general scheme of the building, however, remains untouched. It is obvious that the arrangement is extremely compact, and that the school will be easy to supervise and economical to work. The only objection there appears to be to this form of plan is the difficulty of securing the best aspect for all the class-rooms. A section which makes the arrangement clearer is shown in Fig. 75, and a perspective sketch of the building in Fig. 77.

Streatham Hill High School.—This school for girls, the property of the Girls' Public Day School Company, is in its general scheme similar to the two foregoing buildings, but the difference in detail is

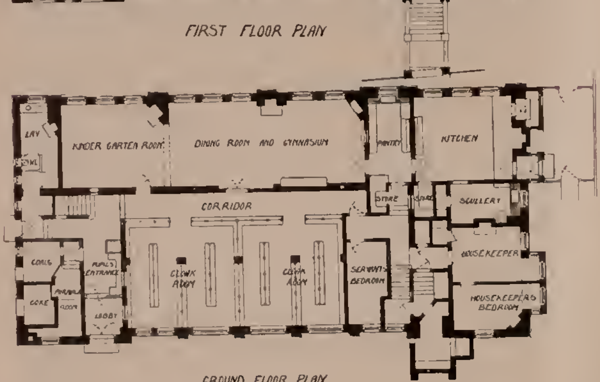
* This is not shown on the plan, but the position of the lavatory can be seen.



SECOND FLOOR PLAN.

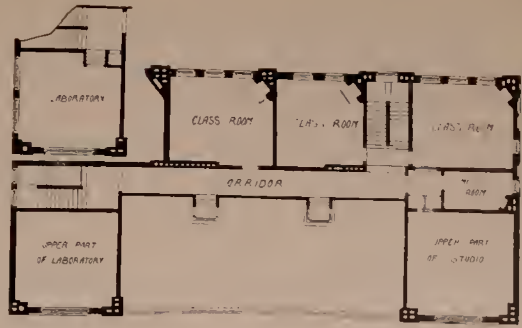


FIRST FLOOR PLAN



GROUND FLOOR PLAN

SCALE 10 5 0 10 20 30 40 50 OF FEET



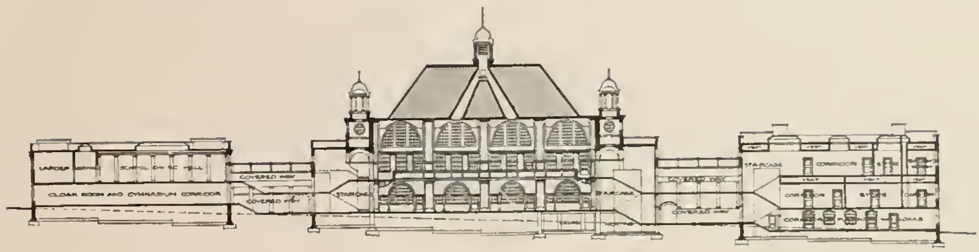
THIRD FLOOR PLAN

INTERIOR OF HALL.

78-82. HIGH SCHOOL FOR GIRLS, STREATHAM HILL.

The Girls' Public Day School Company.

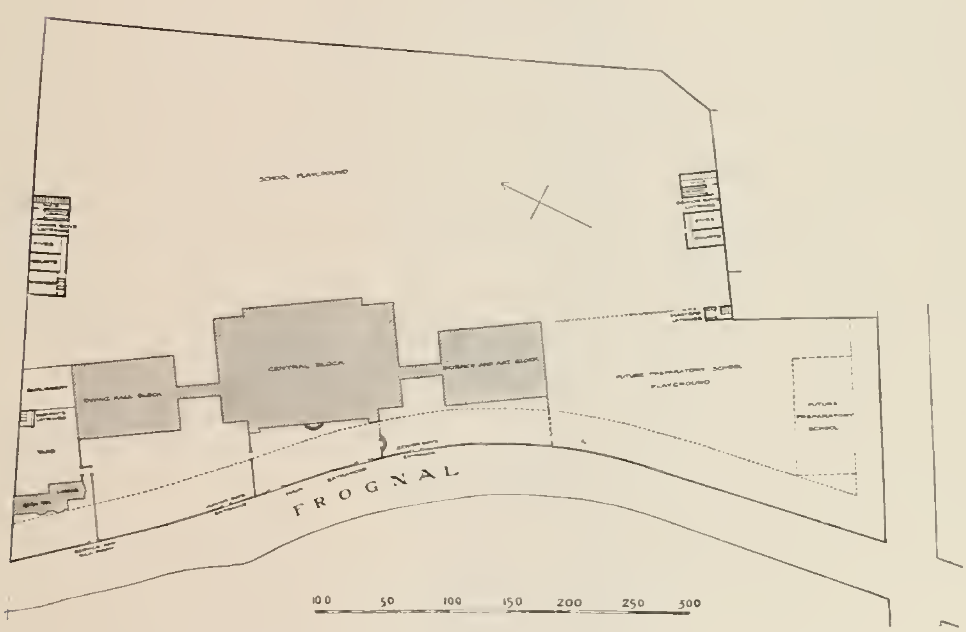
J. Osborne Smith, Architect



Longitudinal Section.

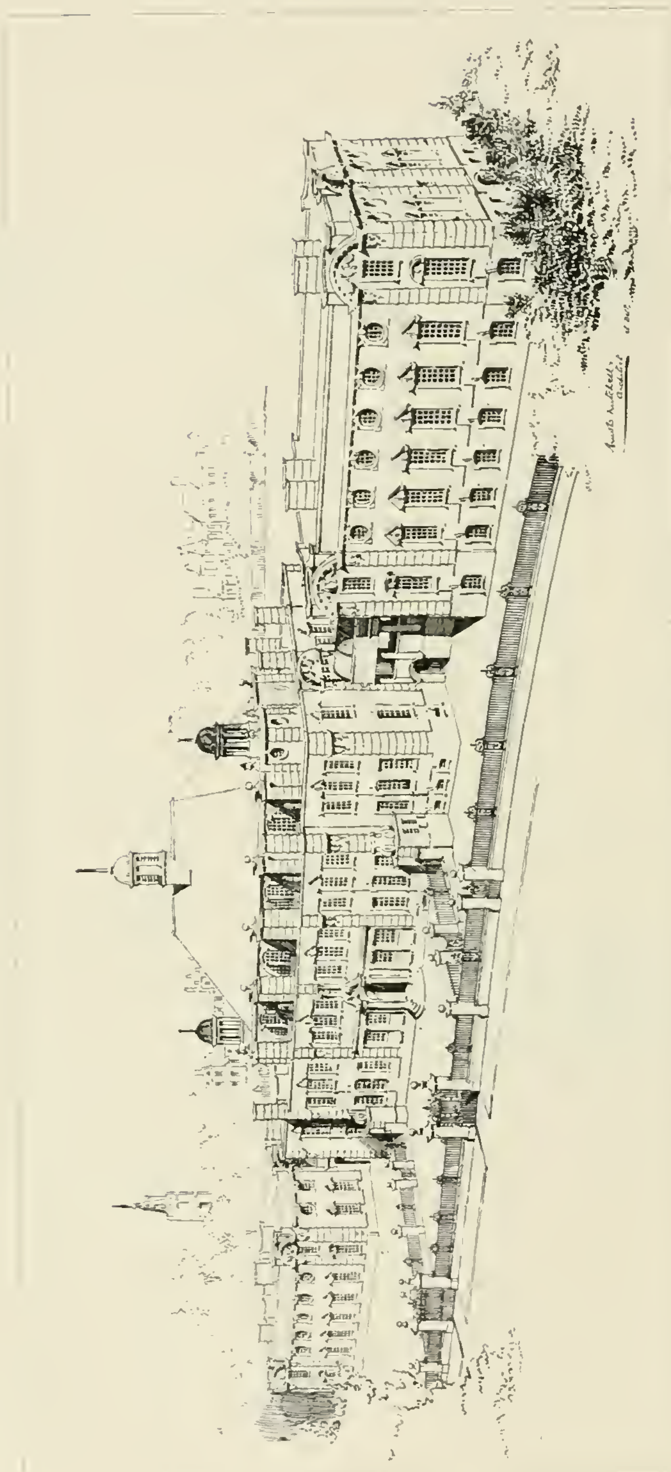
75. New Buildings at Hampstead for University College School

Arnold Mitchell, Architect.



76. New Buildings at Hampstead for University College School.

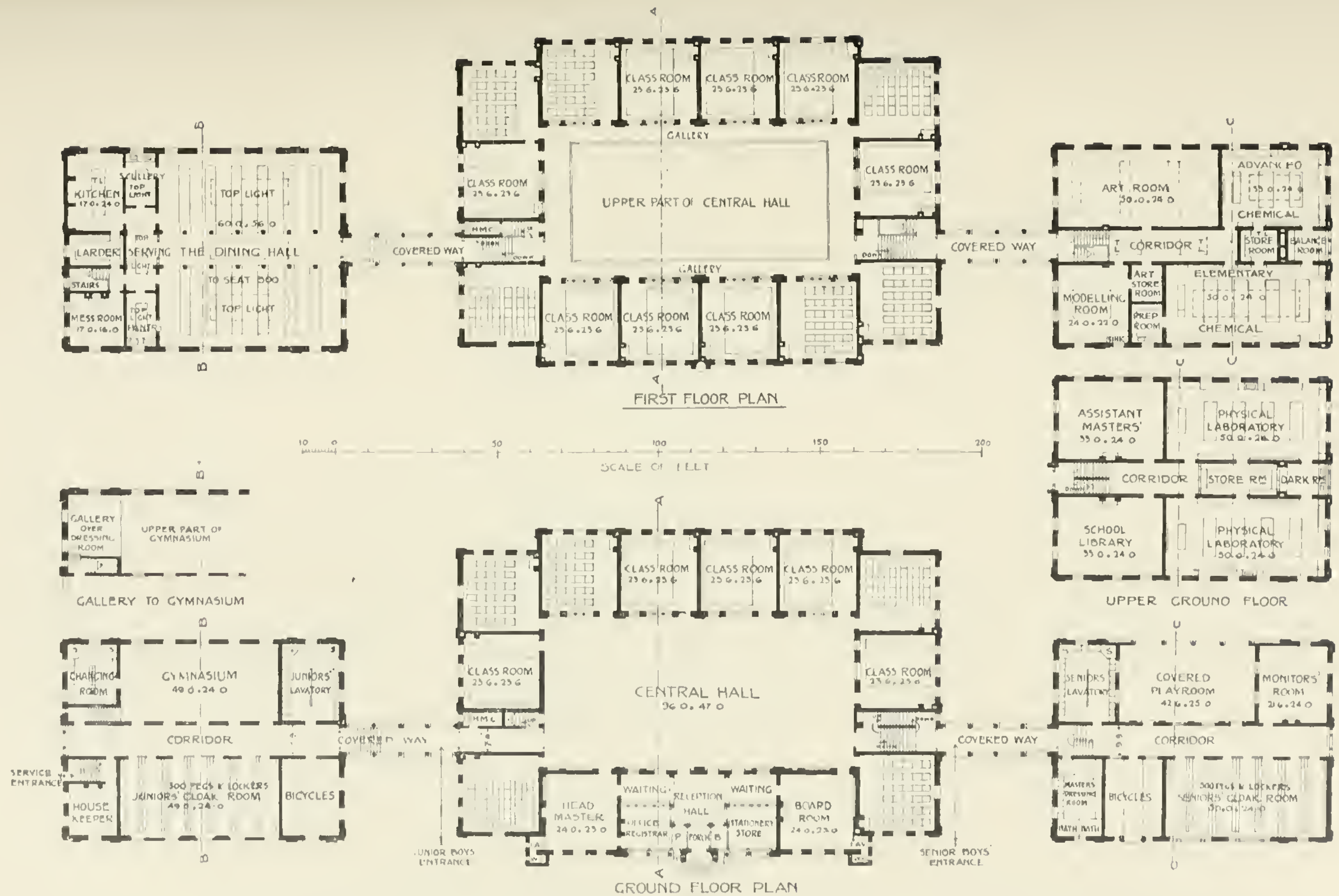
Arnold Mitchell, Architect.



77. Perspective Sketch.

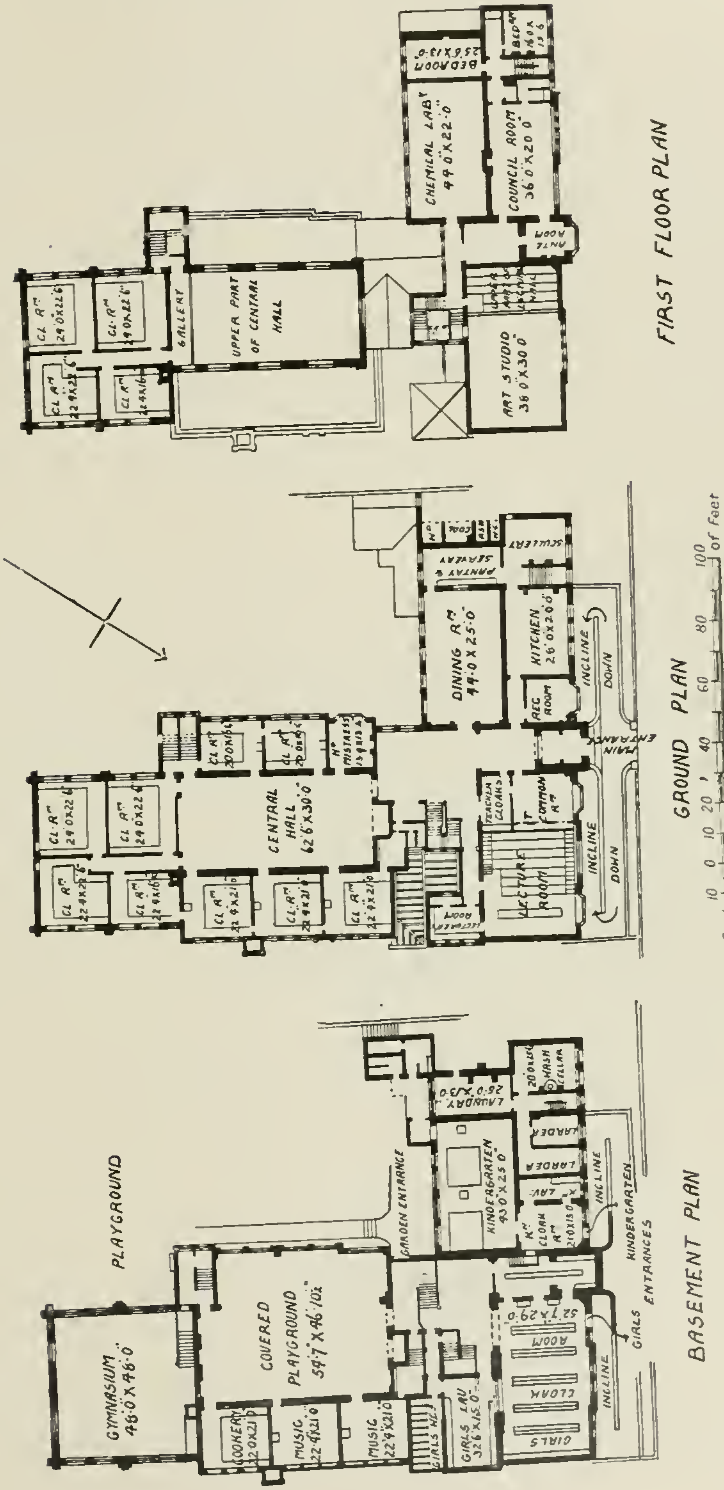
New Buildings at Hampstead for University College School.

Arnold Mitchell, Architect.



73, 74. UNIVERSITY COLLEGE SCHOOL, NEW BUILDINGS AT HAMPSTEAD.

Arnold Mitchell, Architect.



83-85. High School, Blackburn.

Stones & Gradwell, Architects.

considerable. In the first place will be noticed the large space devoted to cloak-room accommodation, due to the fact that it is a Girls' School. For the same reason it is necessary to have all the offices inside the building. While the class-rooms are grouped round the hall, there is only one on each floor that actually opens into it. The object of this is to keep the hall as quiet as possible. The class-rooms are all arranged on the south-west side of the hall, while the studio is provided with a north light. In order to increase the accommodation in the hall for prize-givings and other functions, the studio is so arranged with a sliding partition (see Fig. 80) that a number of people can be seated there with a view into the hall. Additional class-room accommodation has recently been added at the south-east corner, where the provision made for the purpose is shown on the plan, and the school now takes nearly 300 pupils. An interior view of the hall is shown in Fig. 82.

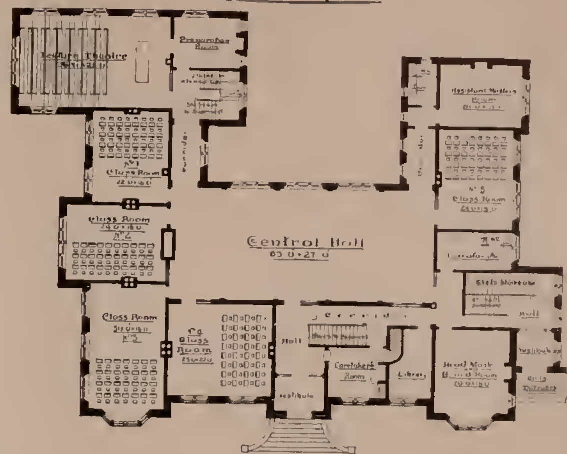
The High School, Blackburn.—Figs. 83-85 show the original design for this school; the building itself was not carried out at once in this form. These plans provide very complete accommodation for a school of about 400 girls. A covered playground and gymnasium are placed in the basement; on this floor is also placed the Kindergarten, opening directly into the garden, with separate cloak-rooms, &c. The hall is placed in the centre of the building, with rooms on four sides lit by windows over the class-rooms upon either side.

The Dewsbury Grammar School.—In Figs. 86-89 are shown the plans and perspective of a conveniently planned and well-arranged school to take some 250 pupils, girls and boys. In the basement are found drying and cloak rooms for both girls and boys, with a separate staircase for each, as well as a large dining-room, gymnasium, and workshops. The large central hall, repeated on two floors, gives direct access into all the class-rooms on three sides, being lit itself from the fourth. A staircase is provided at each end of the building.

The High School for Girls, Sheffield.—This school, also the property of the same Company, again shows a somewhat similar example to the last. By means of corridor down the side of the hall there are no class-rooms opening directly out of it, though they are all easily accessible. In this building there is a covered playground in the basement, in addition to the cloak-rooms, dining-room, kitchen, and offices. The sanitary arrangements are placed on two floors, and, while easily accessible, are shut off from the building by an intercepting lobby. The rest of the arrangement of the building can

FIRST FLOOR PLAN

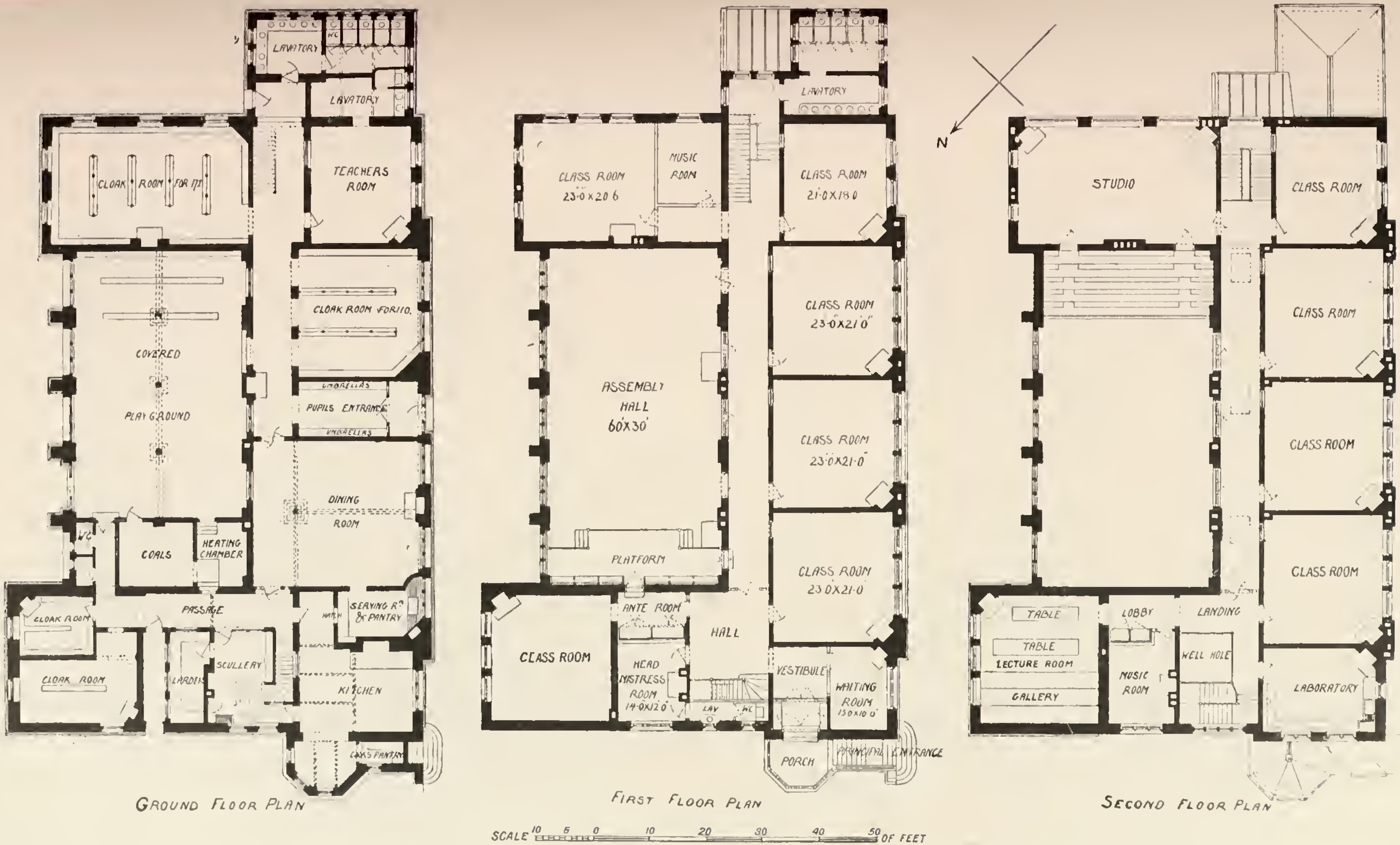
-BASEMENT PLAN-



—GROUND PLAN—

86-89. THE DEWSBURY GRAMMAR SCHOOL.

T. Lane Fox, Architect.



90-92. THE HIGH SCHOOL FOR GIRLS, SHEFFIELD.

The Girls' Public Day School Company. — *J. Osborne Smith & Tanner, Architects.*

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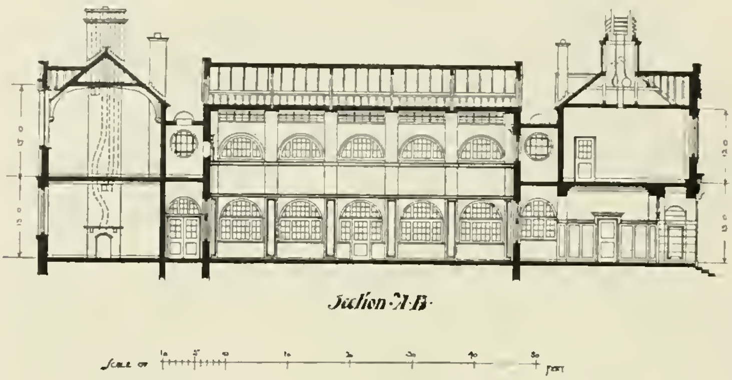
be easily seen from the plan. This school has been opened some time, and has been found extremely convenient and well adapted for its purpose. The chief feature is the corridor, which serves to cut the hall off from the class-rooms so that it can be used for the purpose of drilling, singing-lessons, &c., without interfering with the work going on in the class-rooms. There are about 350 pupils in the school.

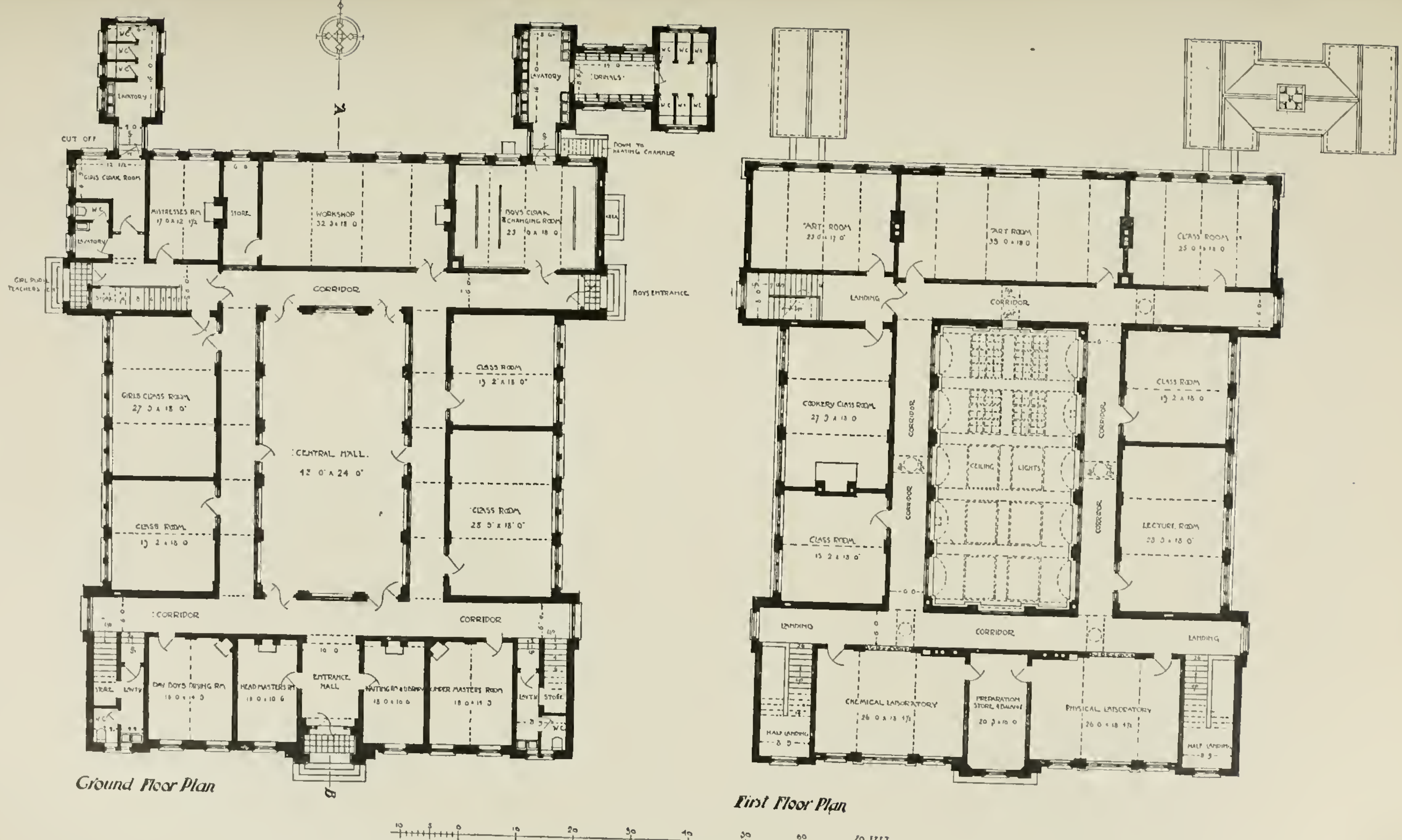


93. School at Brentwood.

94. School at Brentwood.

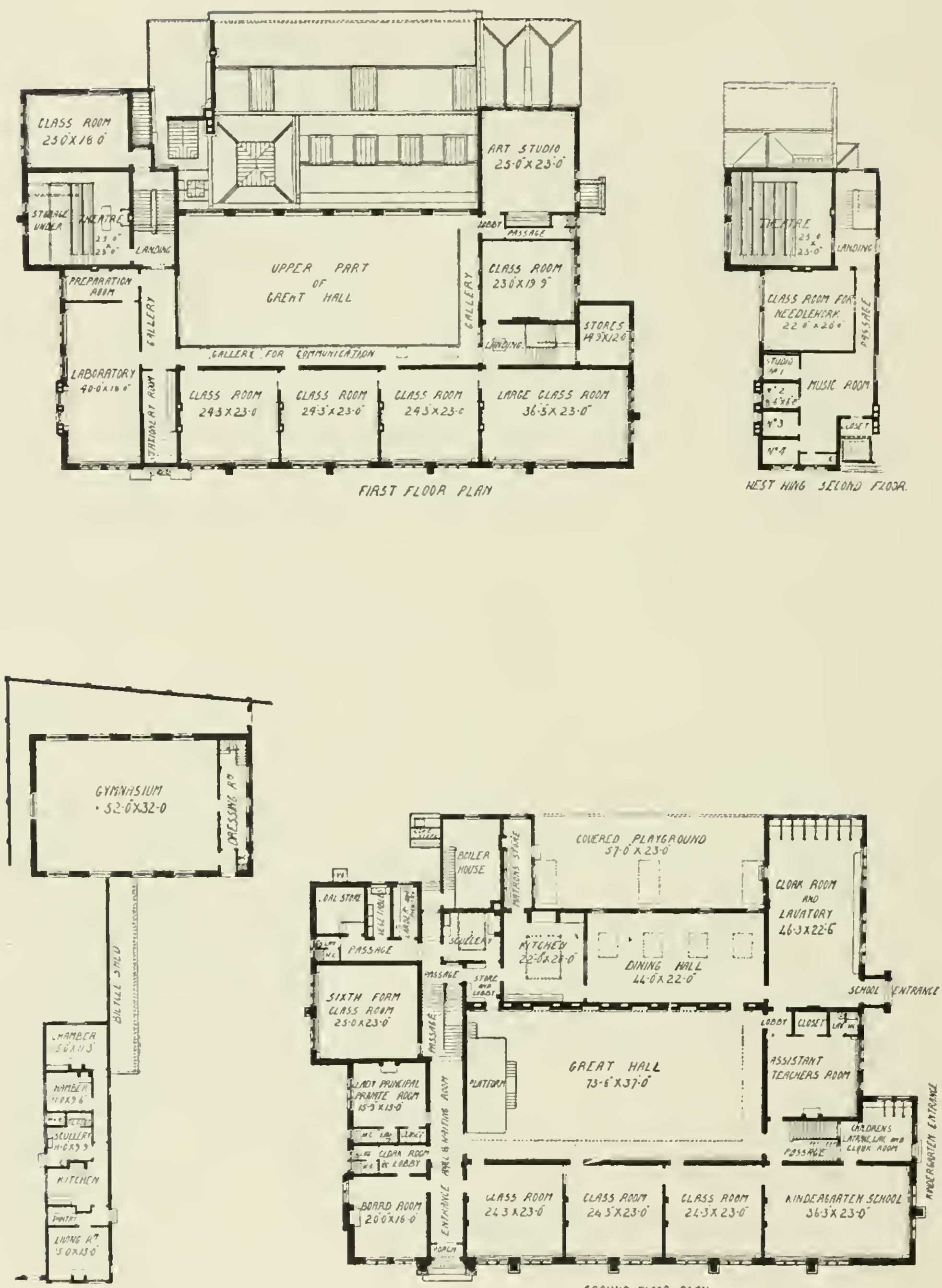
Fred Chancellor, Architect.

Secondary School, Brentwood.—This school, now in process of erection for the Essex County Council, shows an economically planned



95, 96. Secondary School for Boys and Female Pupil Teachers, Brentwood, Essex.

Fred Chancellor, Architect.



97-100. Aske's School for Girls, Acton.

Stock Page, & Stock, Architects.

school with the rooms ranged on all four sides of a central hall, from which they are, however, separated by a corridor. A feature of the building that calls for notice is the class-room and entrance arranged for girls. This is intended to provide for a class of about thirty pupil teachers.

Aske's School for Girls, Acton (Figs. 97-100).—This plan shows a commodious and well-arranged school. The class-rooms are arranged on the three sides of the central hall, opening directly into the hall, but with doors so arranged that it is possible to pass from one to the other without going into the hall. On the ground floor are placed the cloak-rooms, dining-hall, and kitchen; the Kindergarten, with separate cloak-room and offices; form class-rooms, and the Headmistress's room, staff-room, &c. On the first floor the remaining six class-rooms, laboratory, studio, and lecture-room. There is a covered playground provided as well as a gymnasium.

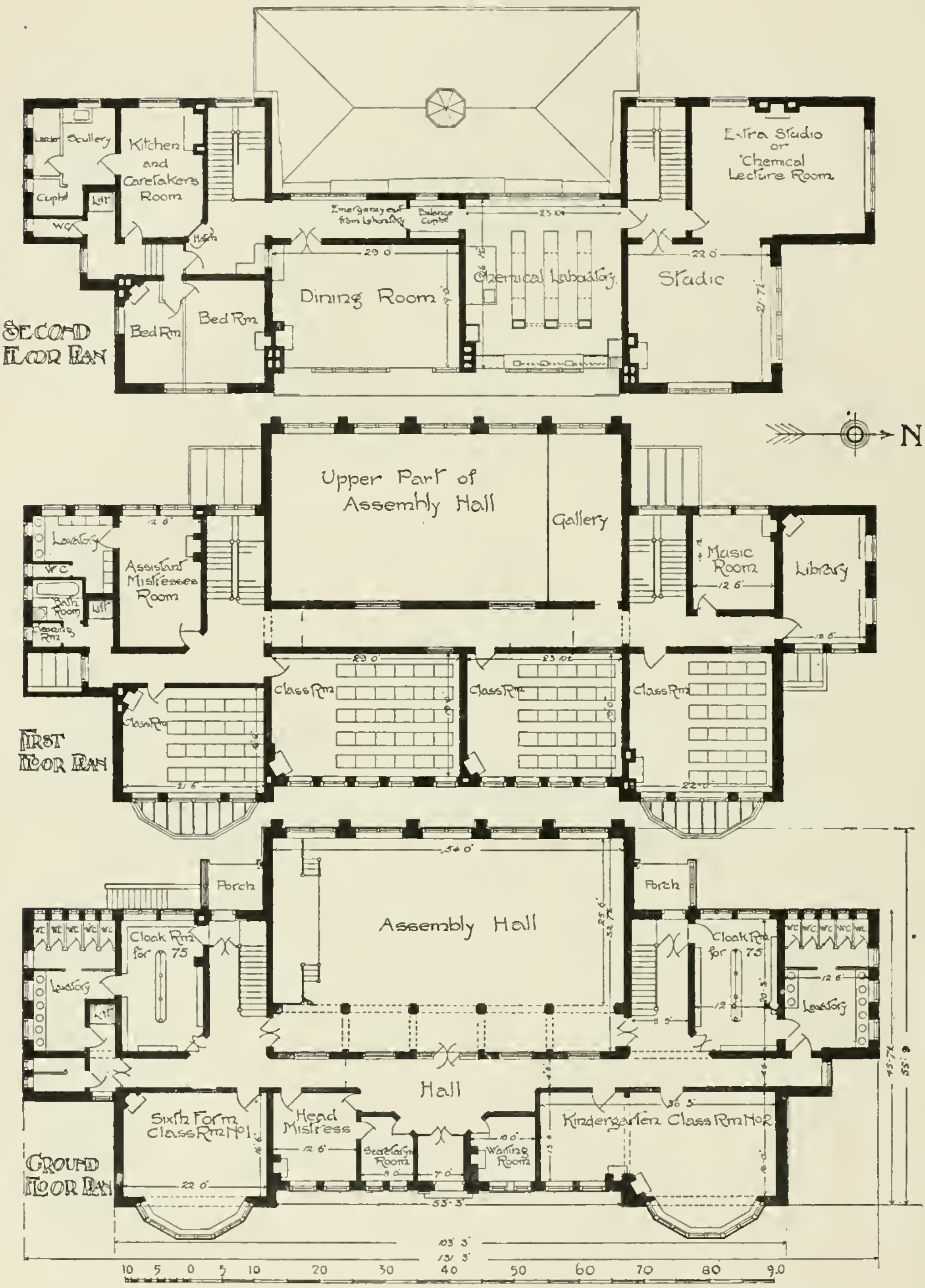
Queen Victoria Memorial High School for Girls, Stockton-on-Tees (Figs. 101-103).—This school, just completed, is intended to take 150 girls, and is planned in accordance with the Rules of the Board of Education for Secondary Schools. Every care was taken to keep the expenses low; including caretaker's rooms, dining-room, and laying out of playgrounds, &c., the cost came to about £46. 10s. per head.

The school is arranged with two entrances, cloak-rooms, &c., for the senior and junior schools respectively, a Kindergarten room being arranged close to the junior entrance. A special class-room with a bay window is provided for the sixth form, while the four regular class-rooms are arranged in a row upon the first floor with the windows to the east.

The offices are cut off from the building by the lavatories, and arranged with an entry from the corridor as well as the cloak-rooms, so that these can be locked up if desired. The caretaker's rooms are placed in a separate block upon the top floor, the kitchen being also intended to supply the school dining-room, and so to keep the smell of cooking well out of the building.

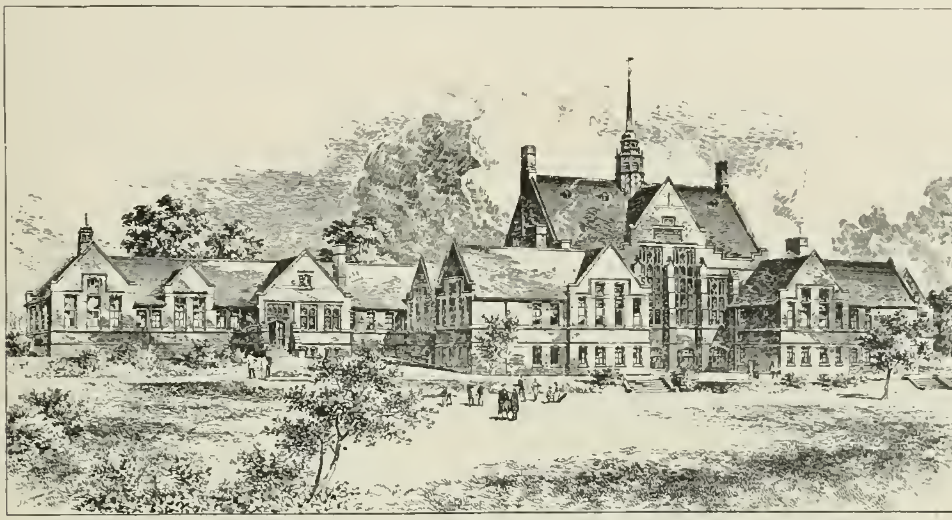
Hulme Grammar School.—Figs. 104 and 105 show the ground plan of a large Grammar School for boys and girls. By means of an arcaded corridor running round three sides of the hall there are thirteen class-rooms so arranged that the entrances to all of them are commanded from the assembly hall. It will be noticed what a large proportion the window space has to the wall space, the latter being reduced to merely narrow piers between the windows.

Hymer's College, Hull.—The plans of this building are shown in



101-103. Queen Victoria Memorial High School for Girls, Stockton-on-Tees.
Felix Clay, Architect.

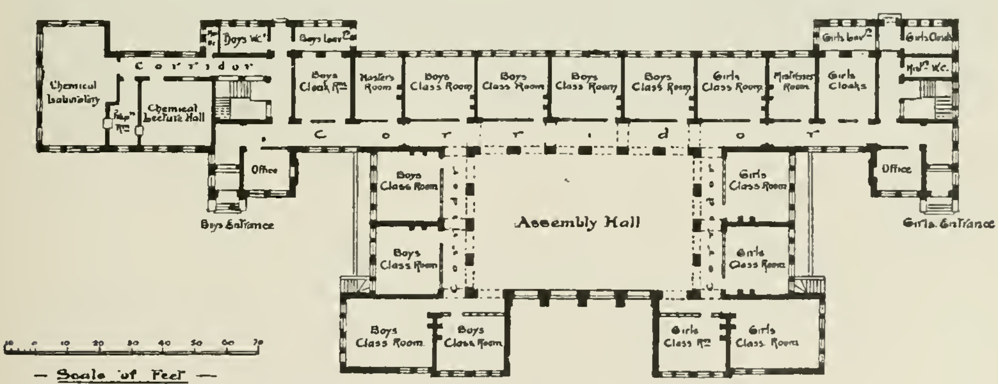
Figs. 107 and 108, with a photograph of the exterior (Fig. 106). The class-rooms are arranged on three sides of the hall, an arcaded passage being provided for communication. The Headmaster's room, offices, and



104. THE HULME GRAMMAR SCHOOL.

J. W. Frith, Architect.

assistant masters' room are arranged on the entrance front. This part of the building is only carried up one floor, so that the windows for lighting the hall can be placed over it. Lockers are placed in the corridors at each end of the hall. Eight class-rooms are arranged on each floor,



105. THE HULME GRAMMAR SCHOOL. Plan.

but only one staircase is provided, which seems hardly sufficient for a school of this size. It will be noticed that all the class-rooms are well lit and of considerable size.

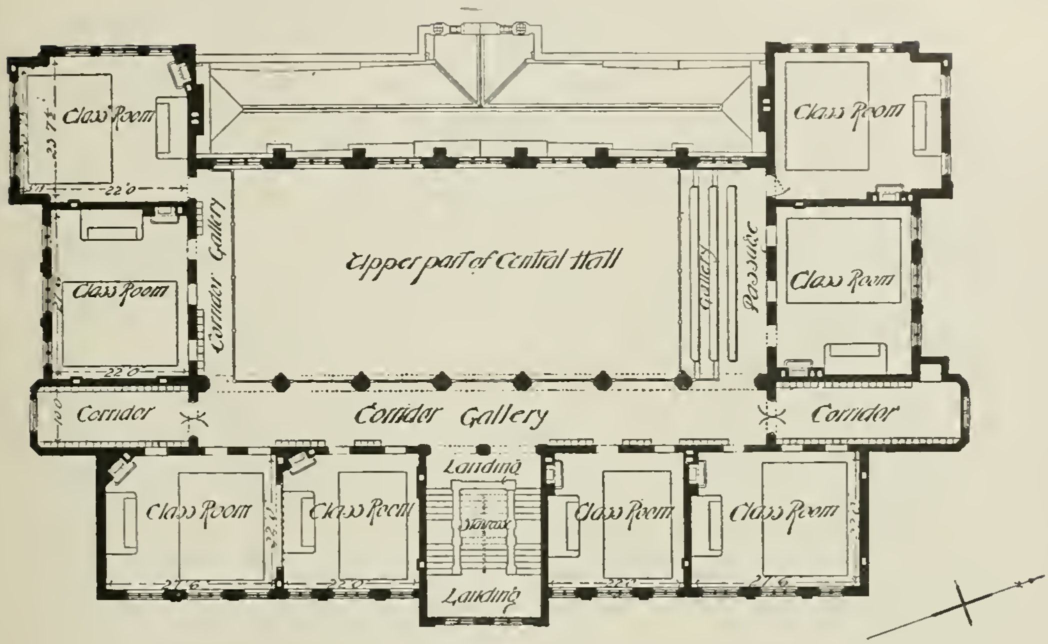
The Wimbledon High School (Figs. 109-111).—All the previous examples are schools in which the class-rooms are placed on three sides of the central hall. The next example shows the arrangement of a building with rooms on the four sides of a hall, lit from the top. This school is an interesting example of economical planning, there being no corridors and no wasted space, while room has been found for a covered playground and ample cloak-room accommodation in the basement. On the ground floor the studio can be thrown into the hall when additional space is required, access to the class-rooms on the first floor

106. Hymer's College, Hull.

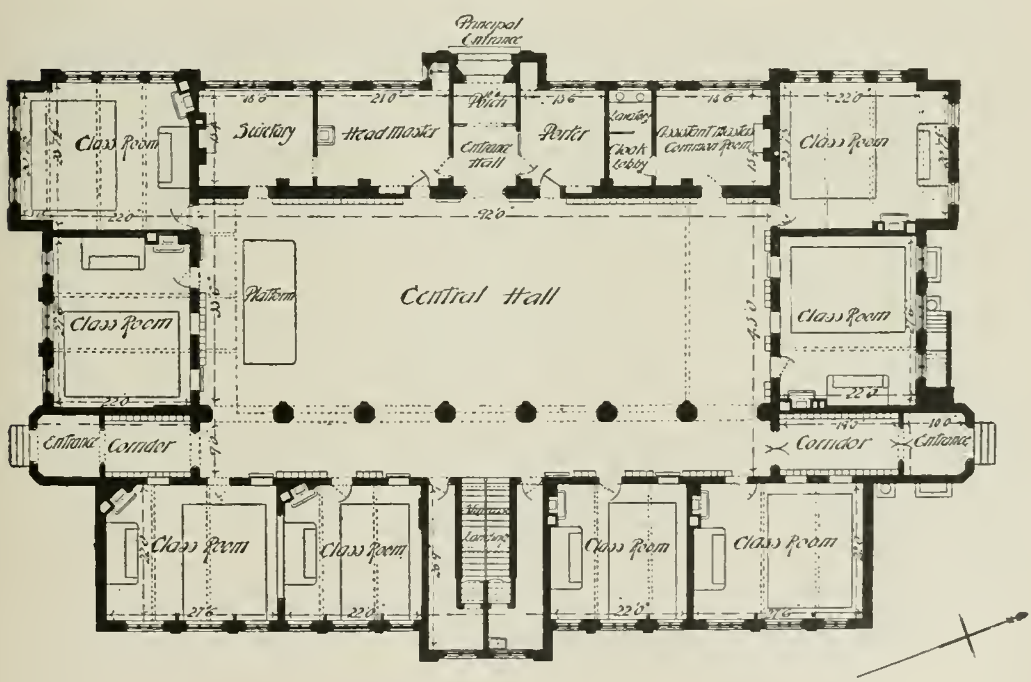
Botterill, Son, & Bilson, Architects.

being provided for by means of a gallery. Though a certain amount of disturbance is caused in the class-rooms by a plan of this kind whenever anything of a noisy nature is going on in the hall, the ease of supervision and compactness of the building are highly spoken of, and from an economical point of view the superiority is marked.

The City of London School (Figs. 112-115).—All the previous examples are various types of the central hall system. It is now proposed to give some examples of schools in which the hall is treated as a



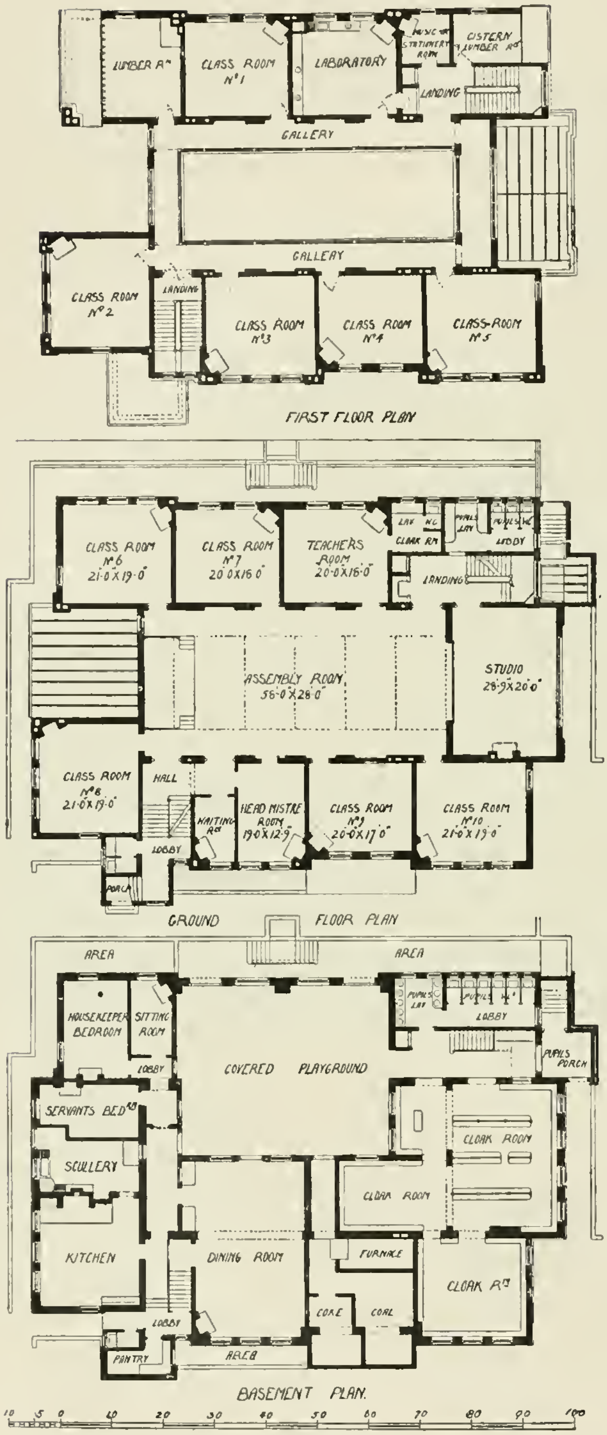
First Floor Plan



Ground Plan

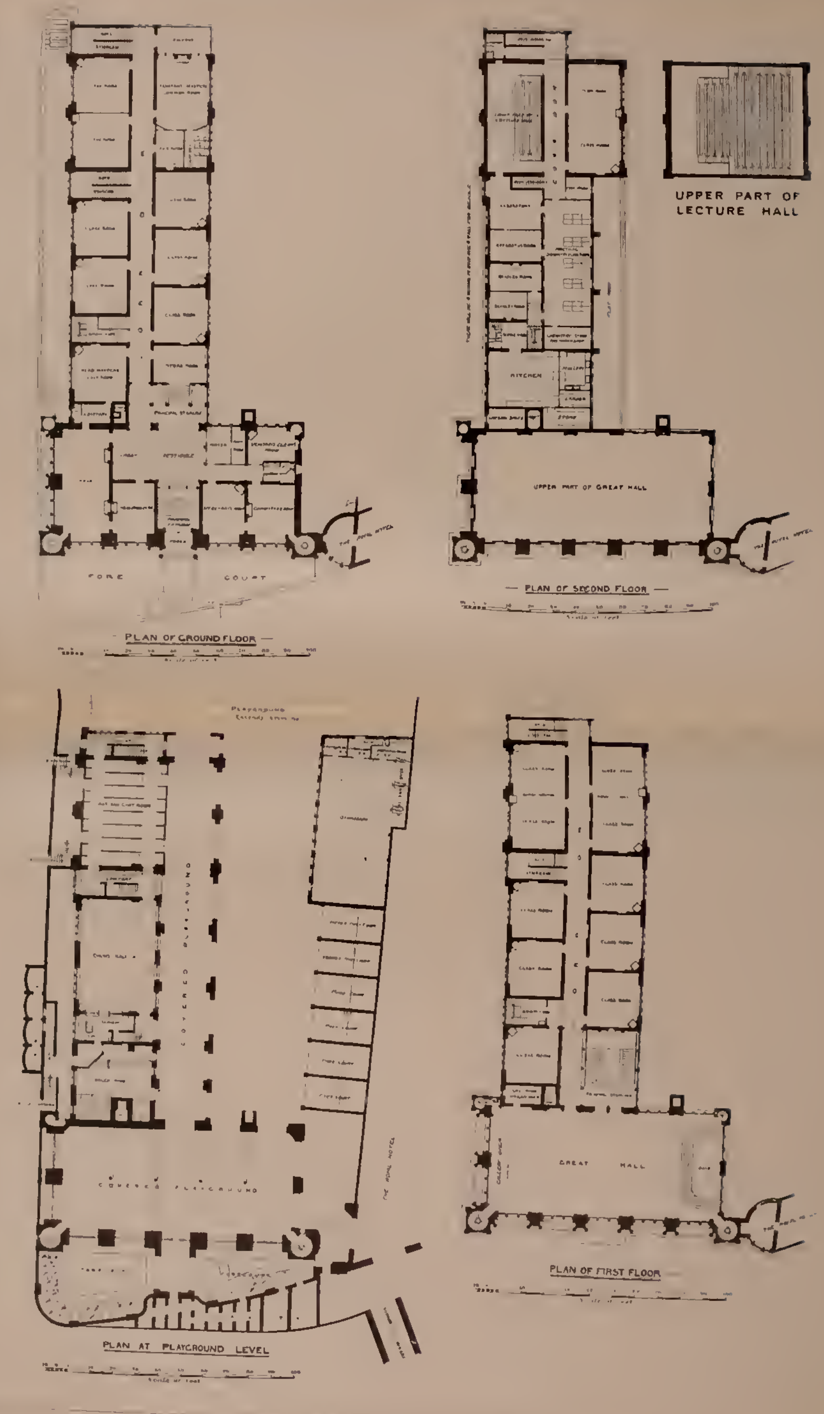
107, 108. HYMER'S COLLEGE, HULL

Botterill, Son, & Bilson, Architects.



109-111. Wimbledon High School for Girls.
The Girls' Public Day School Company.
J. Osborne Smith, Architect.

separate room, with no connection with the class-rooms. The best known, if not the best, example of this type of plan is that of the City of London School. The architects were selected by a competition in which fifty-three took part. The essential feature of the plan consists of a long corridor with class-rooms opening off it on two sides, the hall being situated at one end. The administrative rooms, library, Headmaster's room, &c., are arranged on the ground floor, above them being the great hall running through two storeys. Underneath on the basement level is placed a covered playground on a level with the playground, in which are placed the offices, fives court, and gymnasium. The basement floor is taken up with the dining-room and extensive cloak-rooms, through which the pupils gain admittance into the building. The class-rooms, of which there are twenty, are all of one size, viz., 24 ft. by 22 ft., and are intended to take 40 boys as a maximum number. Their height is 14 ft. 6 in.



112-115. THE CITY OF LONDON SCHOOL.

Davis & Emanuel, Architects.

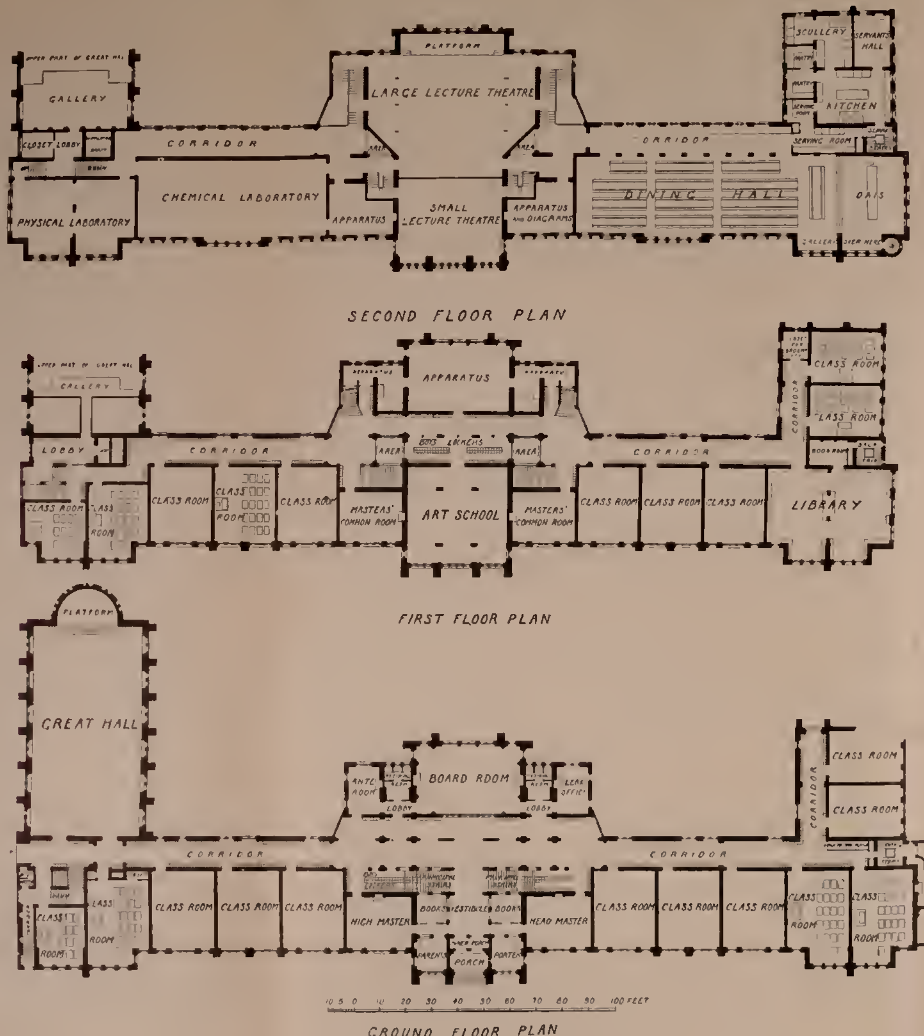


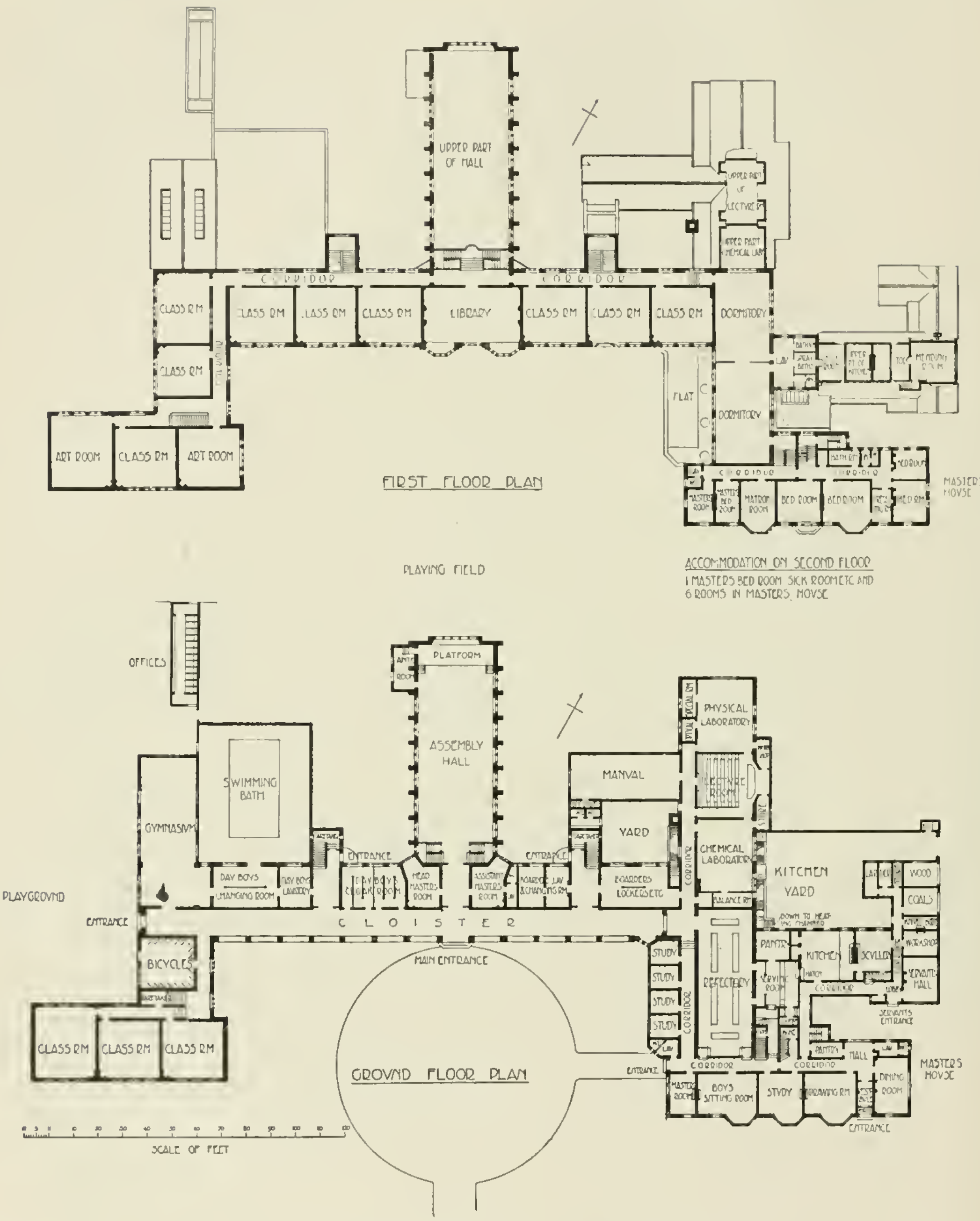
FIG. 121. ST PAUL'S SCHOOL, WEST KENSINGTON.

A. Waterhouse, R.A., Architect

These rooms are heated by ventilating grates (Boyd's) in addition to two Tobin's tubes, while the extract ventilation is provided for by means of a horizontal air passage 3 ft. deep, formed along the top of the corridors, the ceilings of which are thus lower than those of the class-rooms by that amount. These are connected with a tall upcast shaft from the furnace in the basement. Each class-room has two openings into the duct. On the top floor ample facilities for science teaching are supplied, including a large lecture-room. The kitchen is also placed on this floor with a lift down to the dining-room, which is placed in the basement. There are two staircases in addition to the principal stair which leads to the great hall. A useful feature, and one worthy of notice, is the provision of two turret staircases leading to the dais at the end of the hall, one leading from the committee-room and one from the sixth form library—a most convenient arrangement when any function is taking place in the hall. The hall itself measures 100 by 45 ft.

The Lincoln Grammar School.—A more recent example of this type of school is that of the building now in course of erection for the Lincoln Grammar School. The ground floor is arranged with a long open corridor forming a cloister which connects the various parts of the building and gives access to the class-rooms. The separate studies, as well as the living-rooms in the boarding-house, which forms part of the Headmaster's residence, should be noticed. A perspective view of the effective and attractive exterior is shown in Fig. 118.

St Paul's, West Kensington.—As another example of a large Day School for boys there is illustrated in Figs. 119-121 St Paul's School, West Kensington. This building is also arranged on the principle of a long corridor with the rooms opening off it. In this, on the ground and first floor are arranged the boys' lockers, each boy in the school having one fitted with lock and key. The great hall, measuring a little over 80 ft. in length by 43 ft. in breadth, is situated on the ground floor. This hall has been found to be hardly large enough for the size of the school. The class-rooms, of which there are twenty-two, were originally designed to hold 40 boys, but, as has been already mentioned, the school is very highly staffed, and few forms reach as large a size as 20 pupils. The top floor is devoted to science teaching, and to the dining-room, kitchens, &c. The chemical laboratory is a very fine room, and can accommodate, if necessary, about 50 pupils at work on practical chemistry at the same time, while near to it is a very large lecture-room. The dining-room and kitchen are particularly worth notice for the convenience of their arrangement.



116, 117. THE LINCOLN GRAMMAR SCHOOL.

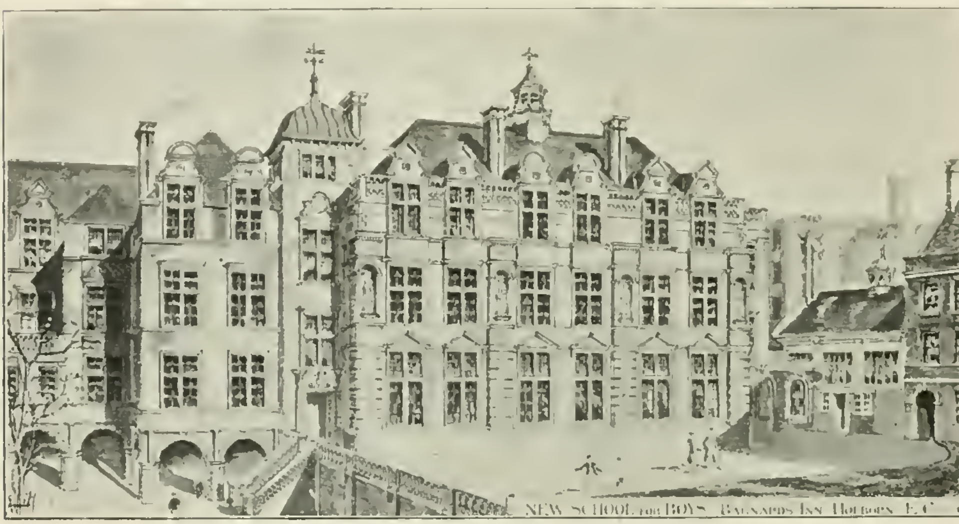
Leonard Stokes, Architect.

118. The Grammar School, Lincoln.

Leonard Stokes, Architect.

The plan of this school is rather suggestive of the arrangement of a German Gymnasium, and would probably serve better for a school organised on Continental lines than for an English School, where it is customary to collect the school once or twice every day in the central hall. The class-rooms are placed on one side only of the corridor, so that it is a long way from the farther rooms to the great hall, the entrance to which is also rather cramped for the rapid movement of large numbers. The class-rooms are large and excellently lit.

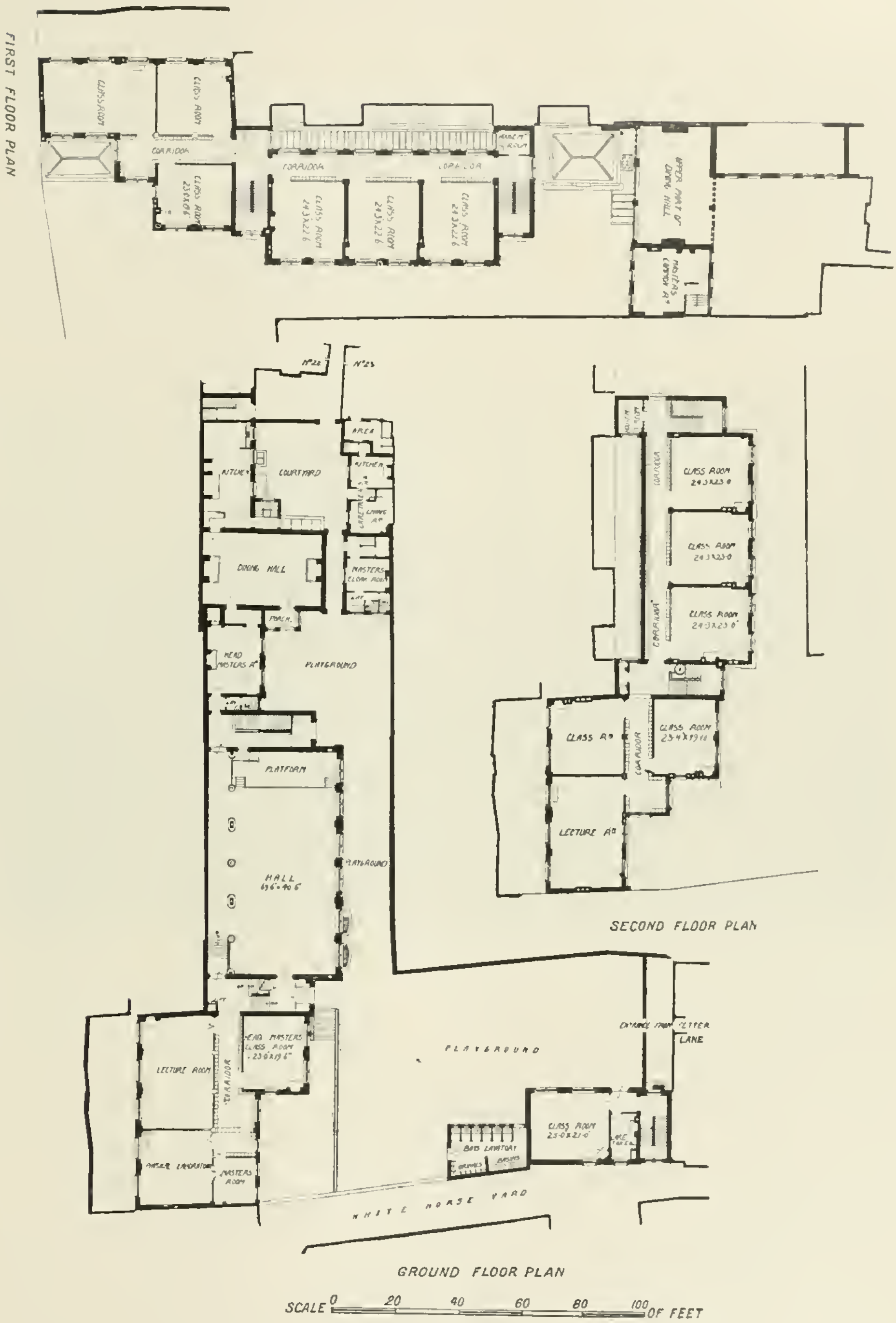
The Mercers' School for Boys, Holborn (Figs. 122-125).—This school, formerly situated at College Hill, was in 1892 removed to its present site in Barnard's Inn. It is an interesting example of a school



122. The Mercers' School for Boys, Holborn.

The Mercers' Company. *T. Chatfield Clarke & Son, Architects.*

planned on an awkward site. The old Inn Hall has been retained to serve the purpose of a school dining-hall, the kitchens having been arranged in connection with it. The school itself lies behind this, a room for the Headmaster having been arranged close to the end of the hall, with a door on to the back of the stage. There is a large and handsomely decorated hall measuring some 70 ft. in length. By utilising a narrow piece of waste ground down the side of the hall, upon which no building of any height could be placed owing to some old rights of light, the architect was able to provide an arcaded corridor to serve as a passage to the rooms beyond. A locker for each boy is provided, these lockers being placed along the corridors, as in the case of St Paul's School mentioned



123-125. School for Boys, Barnard's Inn.

The Mercers' Company. *T. Chatfield Clarke & Son, Architects.*

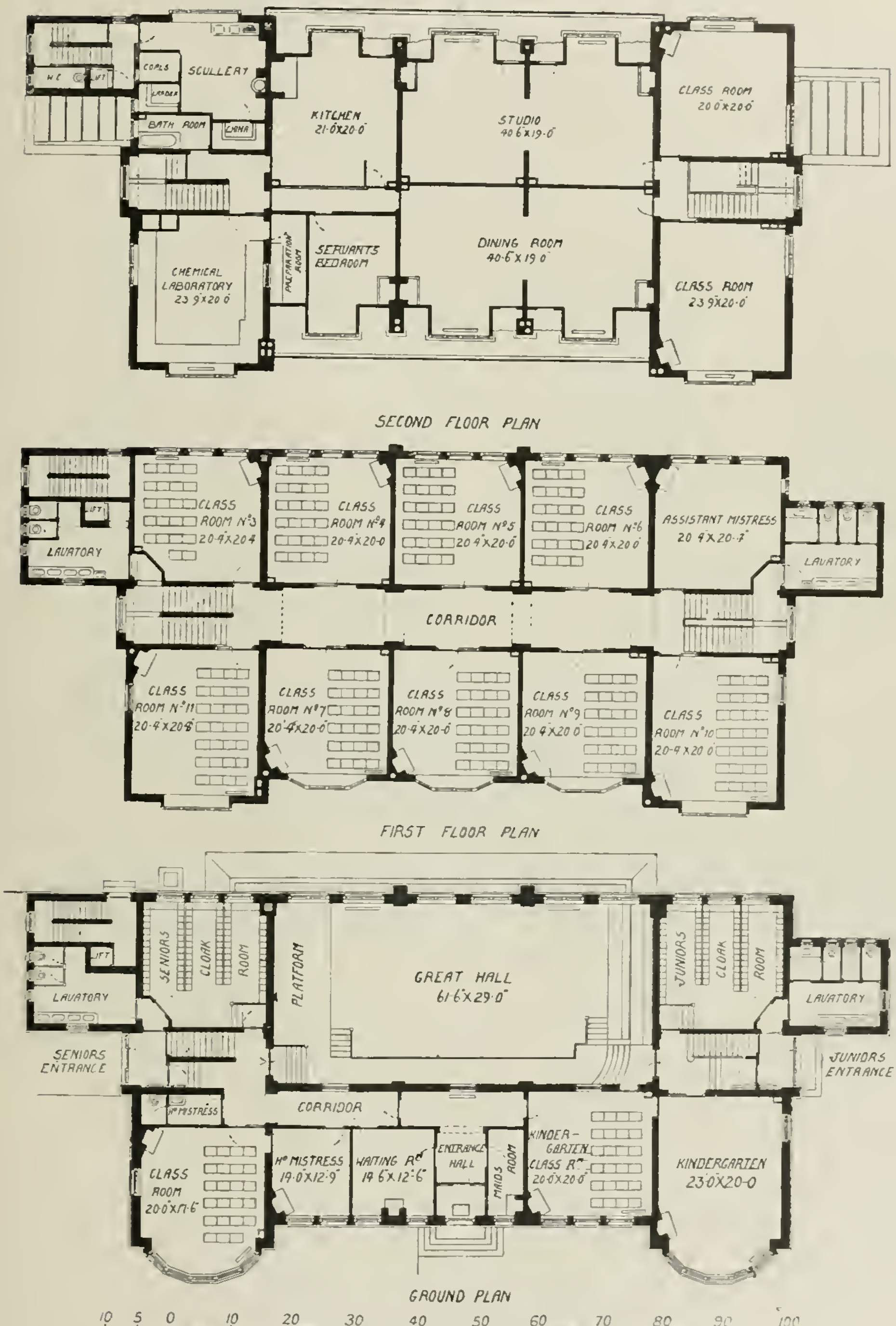
above. Over the hall are placed three class-rooms on both the first and second floor, the remaining rooms being in a block at the end, under which is a covered playground for use in wet weather. The school has accommodation for 300 boys. The block of buildings have been carefully placed in order to interfere as little as possible with the playground. In the corner is placed a building of three floors. The room on the ground floor could serve as a class-room if required, but is used now for a lunch-room for those boys who bring their own lunch with them, and where they can be supplied with tea and coffee by the caretaker, who has a room next door. Above this is a well-fitted chemical labora-

126. THE CENTRAL HIGH SCHOOL FOR GIRLS, NEWCASTLE.

The Girls' Public Day School Company. *Oliver, Leeson, & Woods, Architects.*

tory for practical work, the physical laboratory being in the main building. On the top floor is placed a studio. The class-rooms measure 24 by 23 ft., and, as they are not intended to take more than 30 boys, they provide ample room; they are lit by electric light.

The Central High School for Girls, Newcastle.—This school (Figs. 126-129), recently erected by the Girls' Public Day School Company, shows a school arranged with the dining-room and kitchen upon the top floor. The main bulk of the class-rooms are placed upon either side of a wide corridor on the first floor. This is lit from the ends as well as by borrowed light from the class-rooms, and, as the doors of the class-

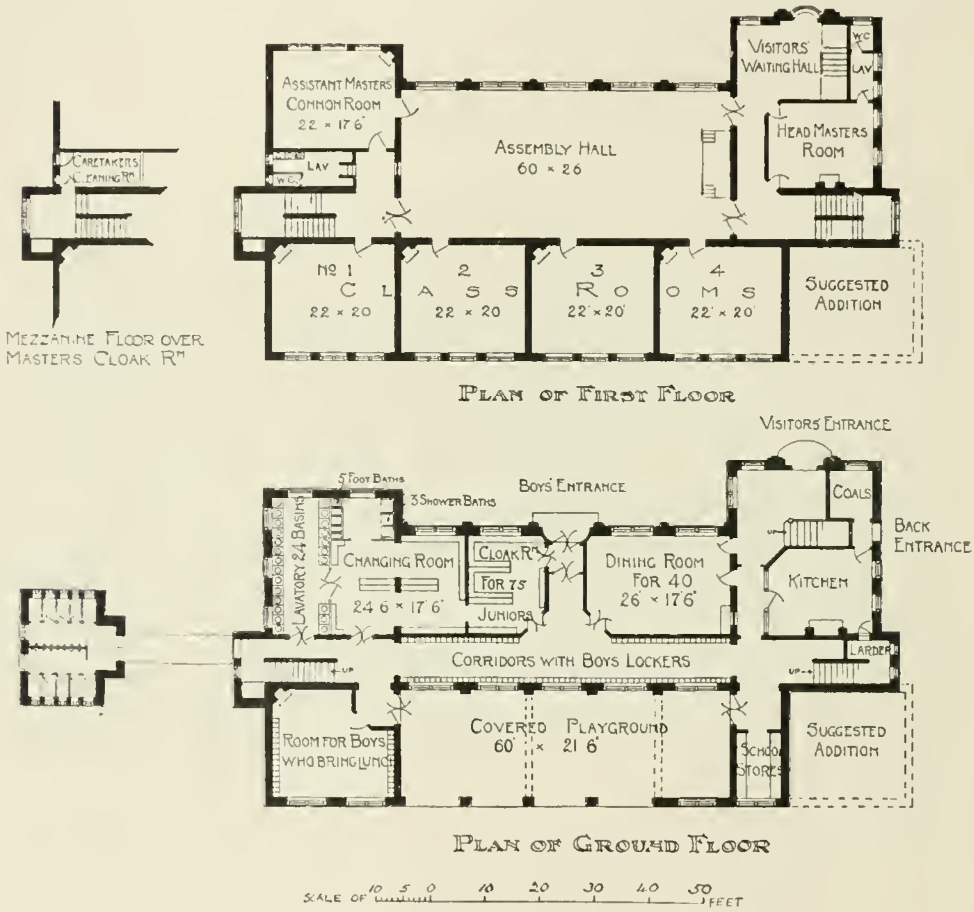


127-129. THE CENTRAL HIGH SCHOOL FOR GIRLS, NEWCASTLE.

The Girls' Public Day School Company. *Oliver, Leeson, & Woods, Architects.*

rooms are glazed, the Headmistress can easily supervise the work of the school. The cloak-rooms are placed in two divisions for the Senior and Junior Department of the school. This has been found a convenient school in practice, and is very economically arranged.

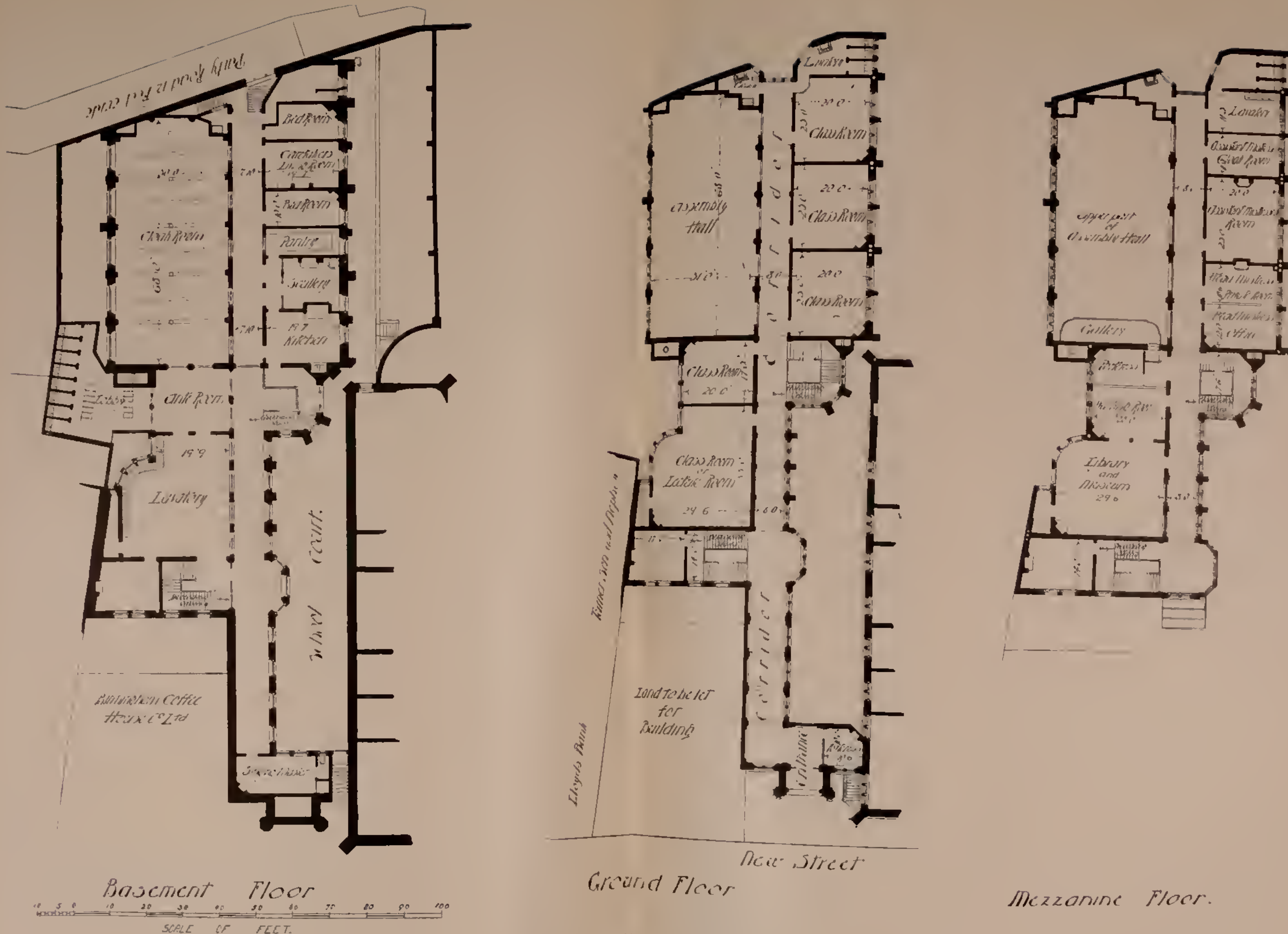
School for 250 Boys.—Figs. 130 and 131 show two floors of a design for a school to take from 250 to 300 boys. The older boys are



130, 131. School for 250 Boys.

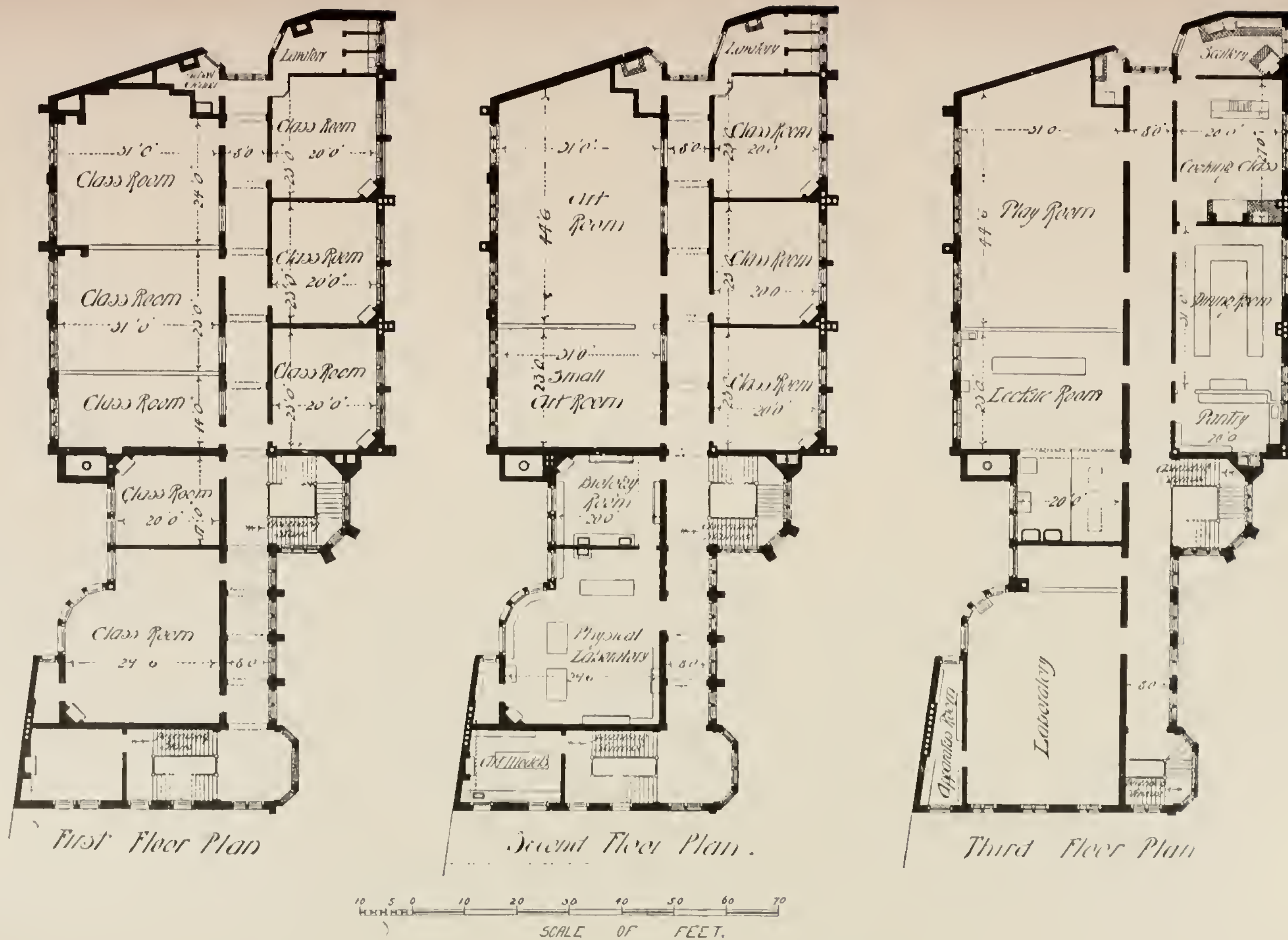
provided with lockers, a small common cloak-room being arranged for the junior boys. The class-rooms have been arranged in order to secure a suitable aspect to the south-east, as well as a left-hand light. There are four class-rooms on the second floor, approached from a gallery, while the rooms for science and art teaching are placed on the top.

The High School for Girls at Birmingham (Figs. 132-137).—Another example of a school on a restricted site is that of the High



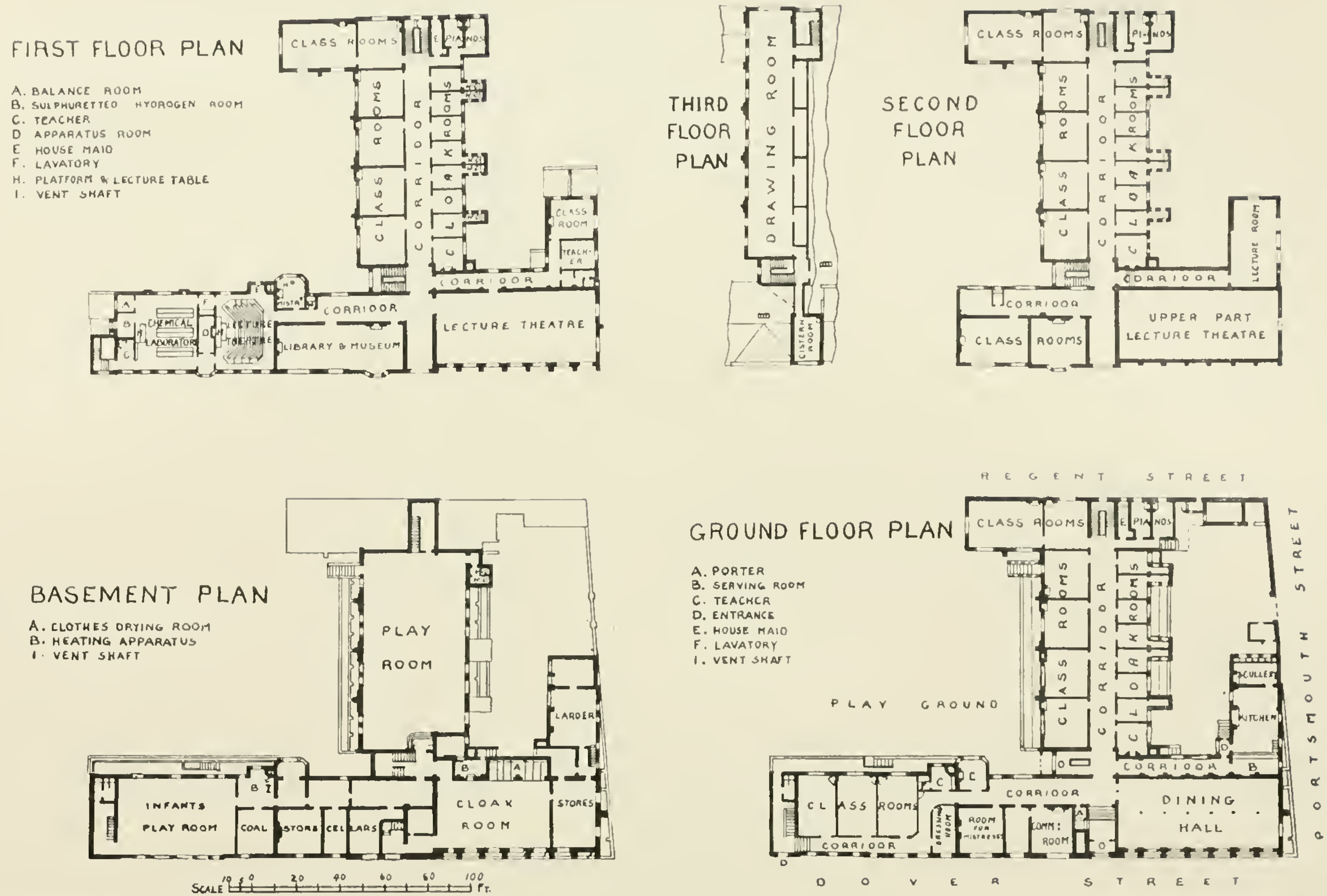
132-134. BIRMINGHAM HIGH SCHOOL.

J. A. Chatwin, Architect.



135-137. BIRMINGHAM HIGH SCHOOL.

J. A. Chatwin, Architect.



138-141. THE MANCHESTER HIGH SCHOOL.

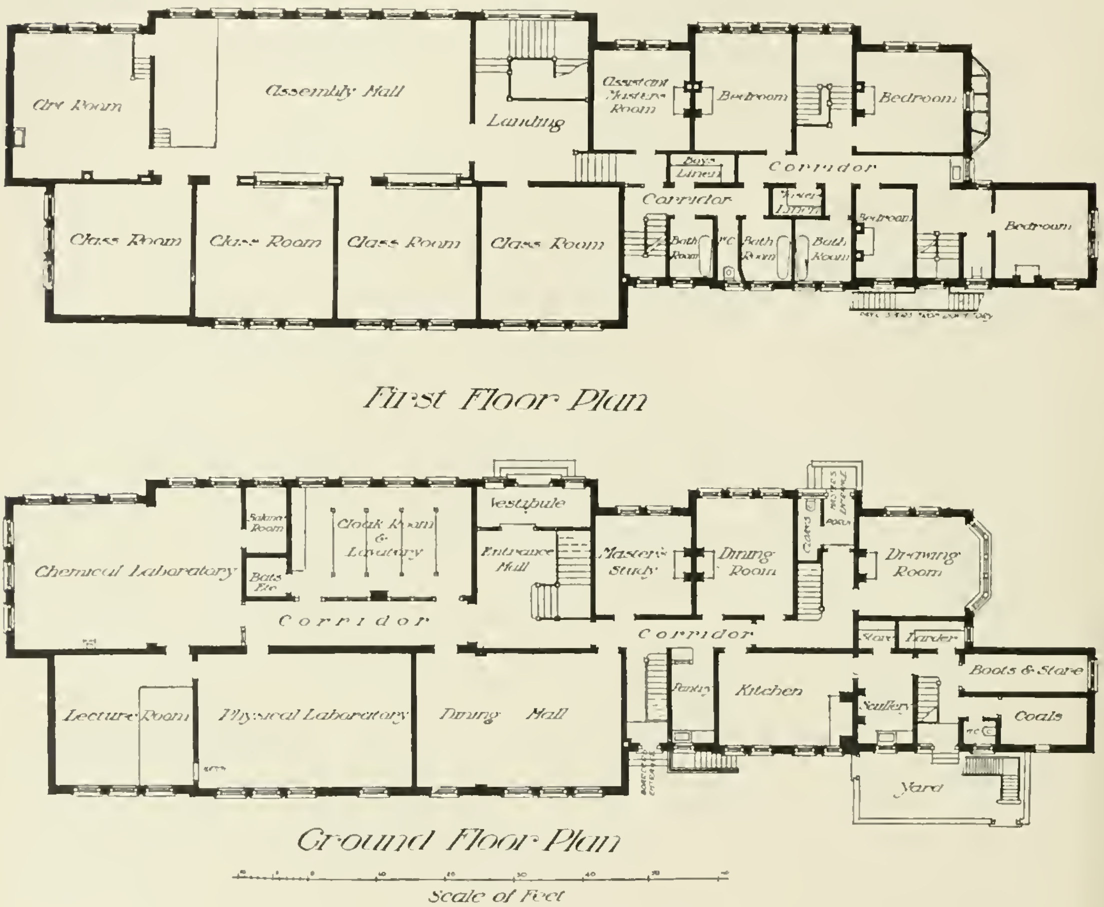
Mills & Murgatroyd, Architects.

School for Girls (Edward VI. Foundation) at Birmingham. This is a very completely equipped school, a very liberal allowance in the way of rooms and space having been given. In order to provide enough area, it has been necessary to carry the building to a considerable height. It consists of six floors, one of which, a mezzanine floor, is not used for educational purposes, and is consequently of less height. Owing to the somewhat awkward and very restricted nature of the site, it was not possible to provide any playground. The girls are, however, able to use the large gymnasium belonging to the Boys' School next door at certain times. In the basement, besides the living-quarters for the caretaker, are the cloak-rooms, lavatories, and offices. The arrangement of these is particularly worthy of notice. There is a staircase down by which the pupils enter the building. When they have taken off their boots and cloaks they enter the school part of the building by another staircase, so that no dirt is brought into the building. Both the lavatories and the cloak-rooms are spacious, making supervision easy, and avoiding all chance of crushing and confusion. Owing to the shape of the site there has to be a corridor to the entrance. This is carried right through the building, with the rooms opening off it on either side. One staircase is used for ascent and one for descent. Above the ground floor is a mezzanine, in which are placed all the rooms for the accommodation of the staff, as well as the library. Above this on two floors are found the remainder of the class-rooms. There are very complete facilities for science work, the teaching of which is made a considerable feature in the school. On the top floor, in addition to the chemical laboratory, is the dining-room and kitchen, and the cookery instruction room, which is fitted with an ingeniously arranged demonstration table having a gas stove in the centre. On the top floor is also a large room which is used as a playroom during the intervals, &c. This room, always useful, is in this school almost a necessity, since there is no playground. A feature worthy of notice is the service-room for cleaning purposes on each floor, with both hot and cold water laid on. Lavatory accommodation is also provided on each floor. This, again, is rendered necessary by the great height of the building.

The High School for Girls, Manchester (Figs. 138-141).—This is an interesting example of a school planned on the corridor system. The most noticeable feature in this building is the arrangement of the cloak-rooms. This has already been described, and need not be discussed again here, but it should be pointed out what a very large amount of space is required for this scheme of cloak-rooms. In this

particular case these cloak-rooms would, if all thrown into one, make a room measuring 100 by 36 ft. There are large playrooms placed in the basement. These are used for drilling, gymnastics, &c. The equipment for science teaching is on a liberal scale and well arranged.

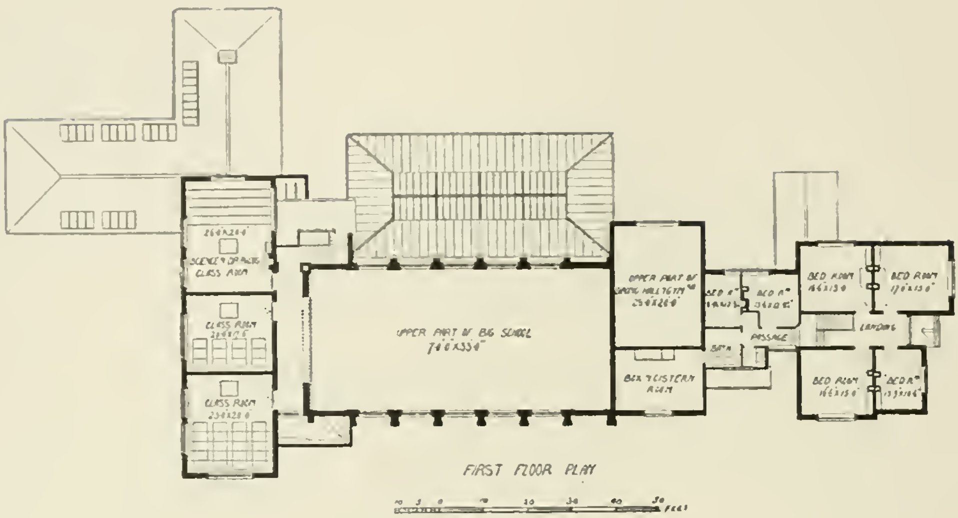
The Farnham Grammar School (Figs. 142-144).—This is a valuable example of a moderate-sized school for about 100 boys, both

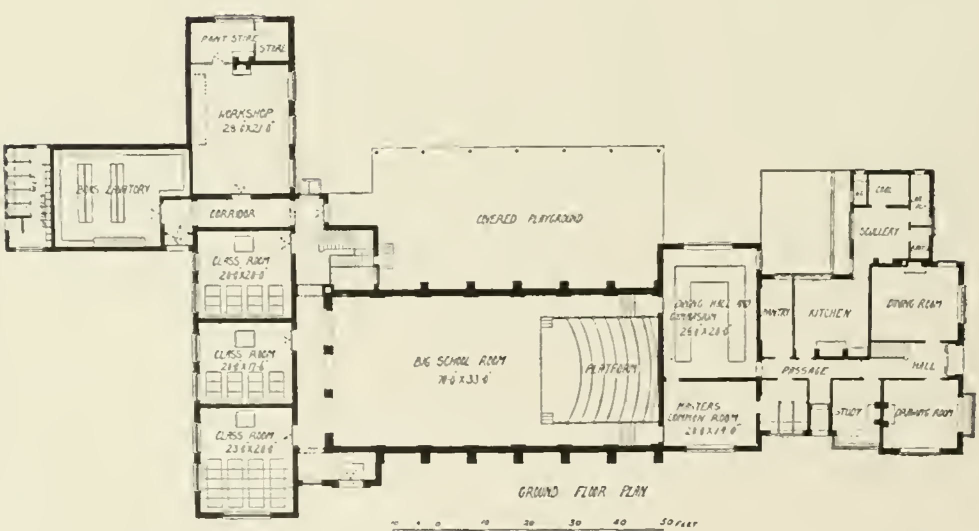


142-144. THE FARNHAM GRAMMAR SCHOOL.

Jarvis & Richards,
Architects to the Surrey County Council Education Committee.

on the score of convenience of arrangement and economy in cost of construction. The school, now in course of erection, was planned for the Surrey County Council Education Committee by their Architects, Messrs Jarvis & Richards. The whole building, comprising four class-rooms, opening off an assembly hall, physical and chemical laboratory,



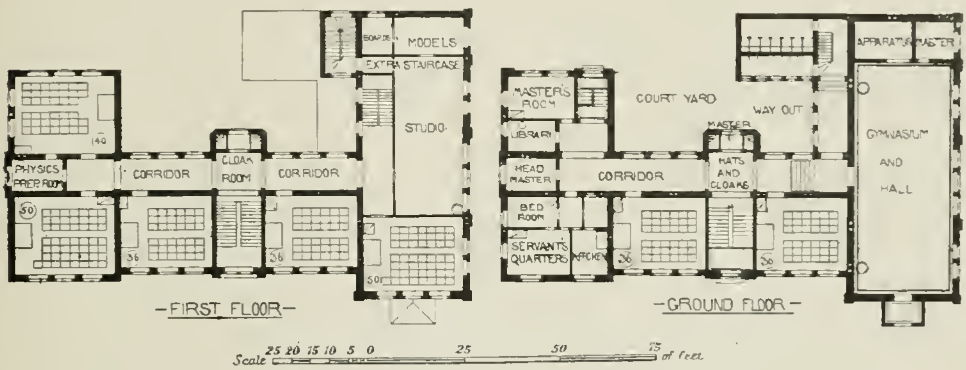


145, 146. THE JUDD COMMERCIAL SCHOOL, TUNBRIDGE WELLS.

W. Campbell Jones, Architect.

lecture-room, art-room, and dining-room, with a residence for the master, containing boarding accommodation for twenty boys, was erected in accordance with the Regulations of the Board of Education for Secondary Schools for £5,600. This sum includes fireproof floors, oak staircase, and oak panelling in the hall.

The Judd Commercial School (Figs. 145, 146).—This school, with class-room accommodation for about 150 boys combined with a house for the Headmaster, is planned so that the hall acts as a disconnection between the masters' rooms and the school, the six class-rooms being grouped at the end of the hall. A changing-room is provided.



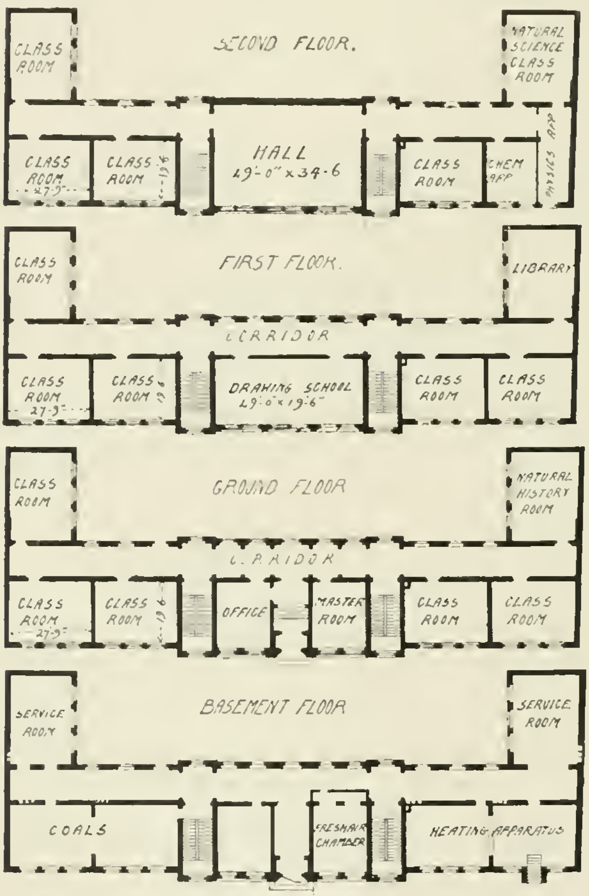
147, 148. A German School. Realschule.

Reinold Faber, Architect.

German Schools.—Figs. 147, 148 show a small and compactly arranged building for a Realschule with seven class-rooms of various capacities from 36 to 50. The ground floor contains the servants' living-rooms, masters' rooms, library, and a large gymnasium which also serves for the purpose of a hall. The first floor is taken up with five class-rooms and a large studio. One of the class-rooms, having a preparation-room for experiments attached, is used for a lecture-room for natural science. This leaves for school purposes six class-rooms, which is the minimum number for a Realschule, the course of instruction in which extends over six years. A larger school of the same kind is shown in Figs. 149-152, which gives the plans of the twelfth, the last and most recently erected of the Berlin Realschulen. The school is very simply planned, the necessary rooms opening off a long corridor. In this example there are sufficient class-rooms to enable any of the forms to be split up into parallel classes.

In the Gymnasia there are found a larger number of class-rooms.

due to the longer course. Fig. 153 gives the plan of a recently erected Gymnasium arranged on the principle of two corridors in the form of an L. The accommodation in this school, *Die Augustinerschule, Friedburg, Hesse,** is as follows:—Four class-rooms to hold 25 for the preparatory department, nine class-rooms for 25 for the gymnasial course, six rooms to hold 45 for the Realschule, and three reserve class-rooms. The other rooms comprise a large lecture-room, studio, singing-school, museum, and library, conference and common rooms, &c. The floor space allowed gives 10 sq. ft. for the younger pupils, and up to 15 for the older. The school has accommodation for 730 scholars.



149-152. The XII. Realschule, Berlin.

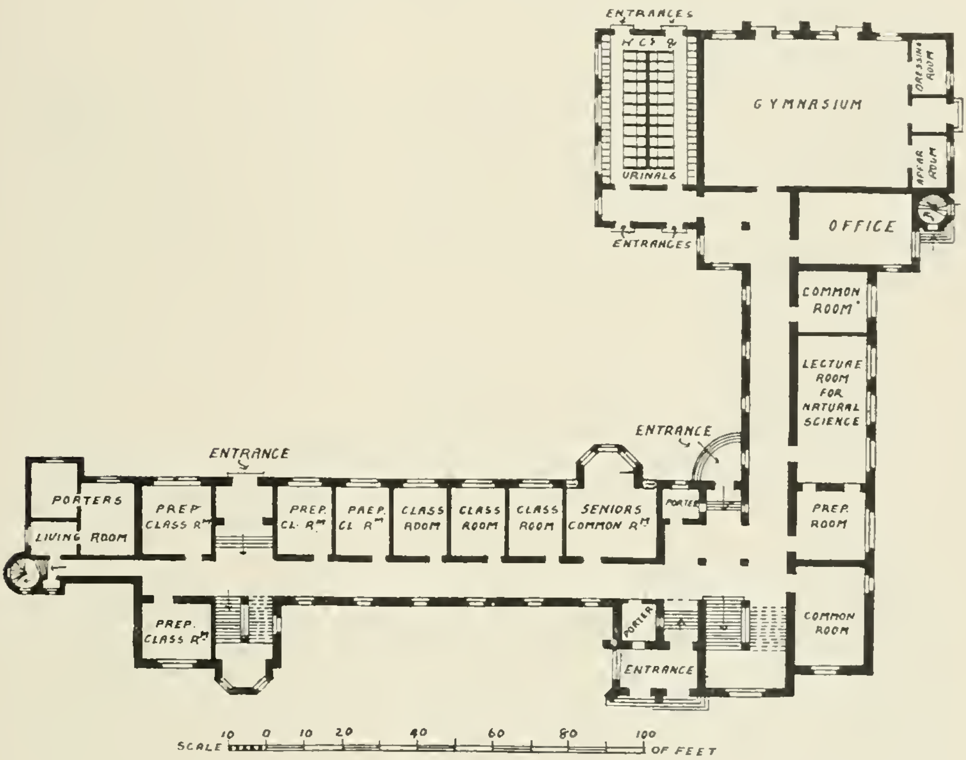
The Kaiser Wilhelm's Gymnasium at Aachen (Figs. 154-156) shows another method of arrangement. The ground floor is taken up by three class-rooms for the preparatory school, conference and Headmaster's rooms, school servants' living-rooms, and the gymnasium, the rooms for the gymnasial course being placed upon the first and second floor. The school is intended to take 600 pupils.

Figs. 157-159 show a combined scheme for an Elementary and Secondary School at Zürich† arranged in two blocks connected by two gymnasiums, between which are placed manual training rooms. A large playground planted with trees separates the two blocks of buildings. A south-east aspect has been obtained for nearly all the class-rooms

* From *Die Deutsche Bauzeitung*, 31st August 1901.

† From Neuere Städtische Schulhäuser in Zürich, A. Geiser, 1901.

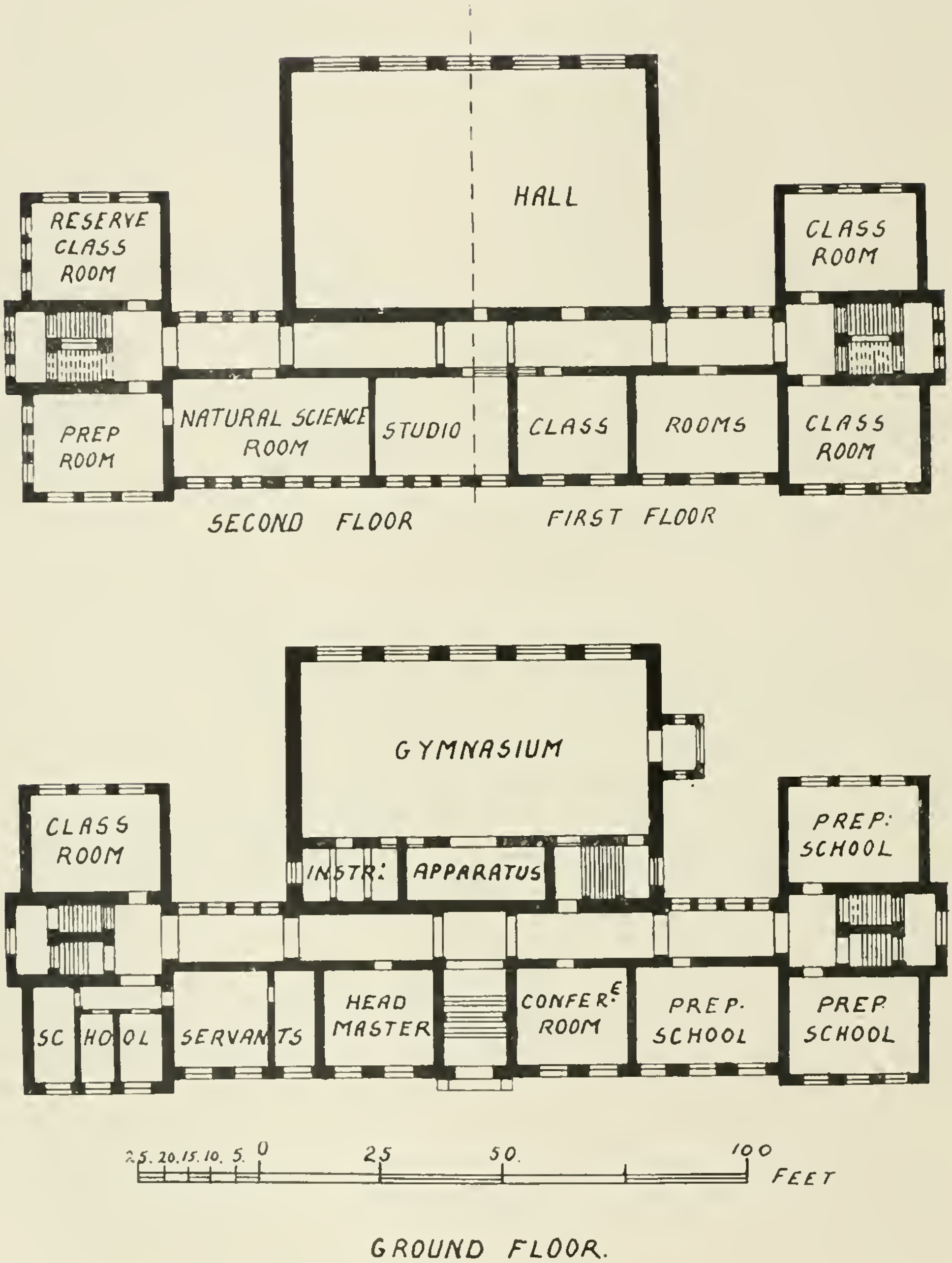
American Schools.—Figs. 160-163 show the arrangement of the *Brighton High School, Boston.* The basement is entirely occupied by the locker-rooms and offices for the boys and girls, and a gymnasium for each. The first* and second floors show well the American system of large schoolrooms, with smaller rooms for the actual teaching called recitation-rooms. The top floor is devoted to science and art work.



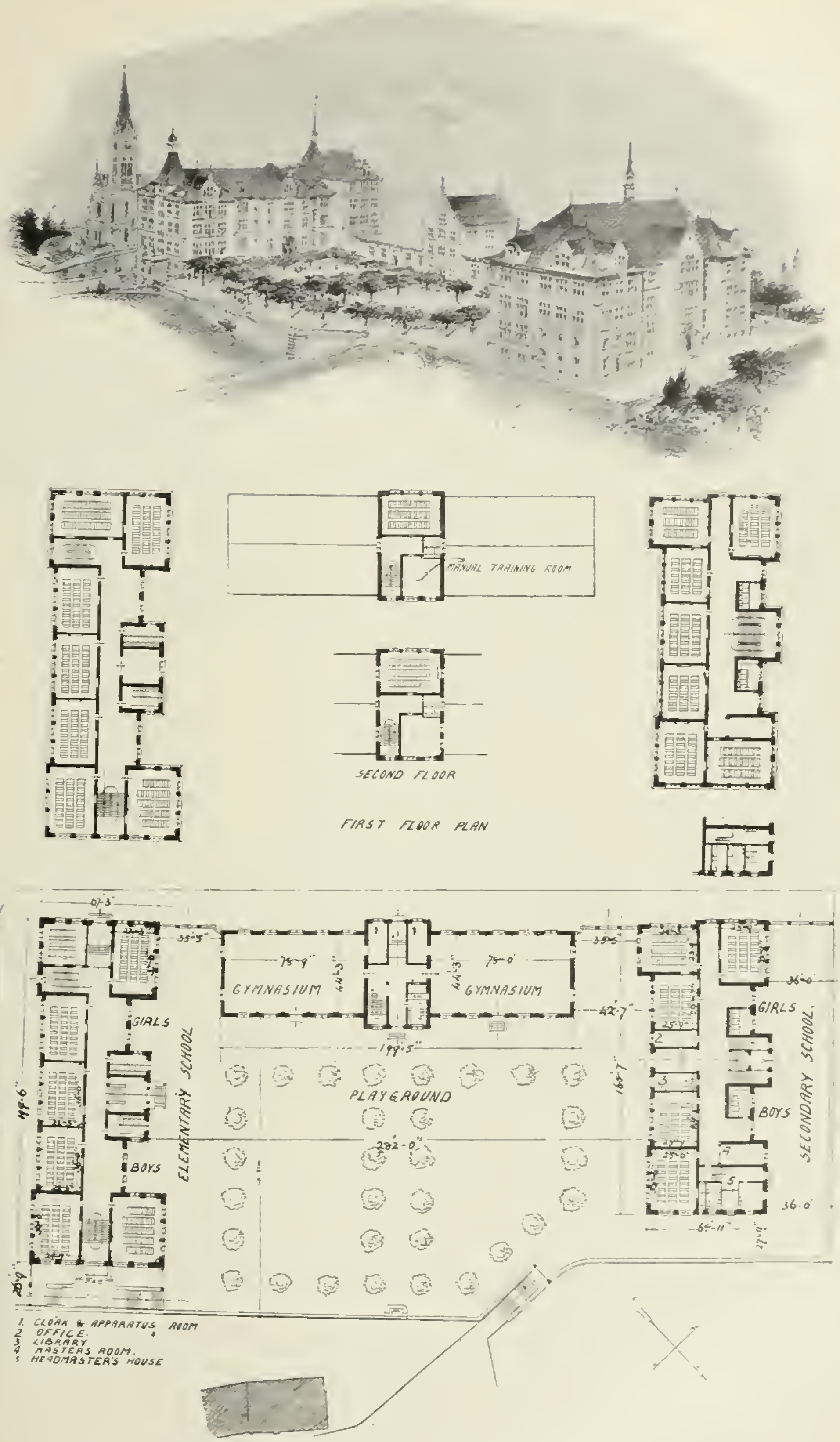
153. Die Augustinerschule (Gymnasium), Friedburg, Hesse.

The Groton School (Figs. 164-166) shows an American Private School, giving a very full equipment of rooms planned on a lavish scale as regards room. The large schoolroom, measuring some 80 by 42 ft., has desk accommodation for 152 students. A small number of cloak-rooms are supplied in recesses taken off a wide corridor.

* Note the first floor is that which would in this country be called the ground floor.



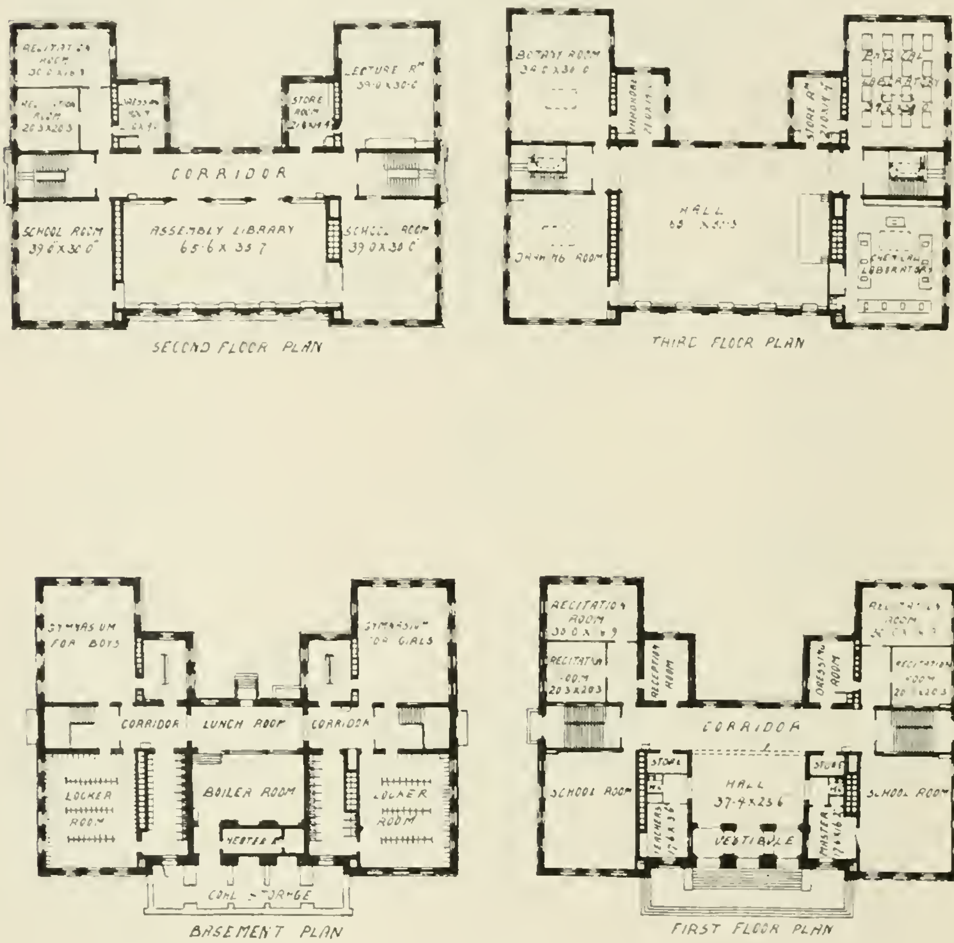
154-156. KAISER WILHELM'S GYMNASIUM AT AACHEN.



157-159. Combined Elementary and Secondary Schools at Zürich.

A. Geiser, Architect.

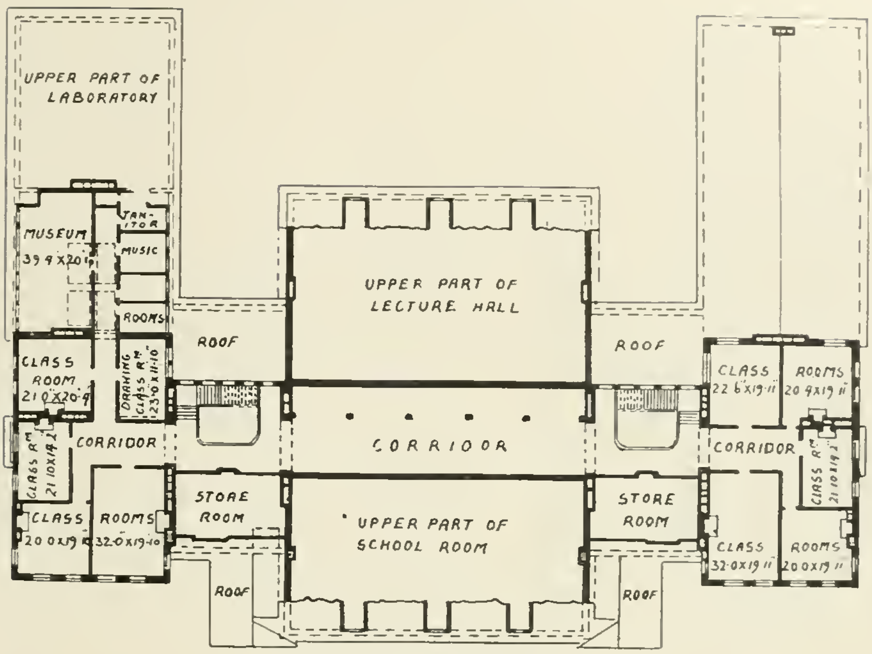
The organisation of American Schools is practically the same for the different grades, the Primary, Grammar, and High Schools all forming part of one course. This approximates more to our modern system of Board Schools than to that of the continually reclassified



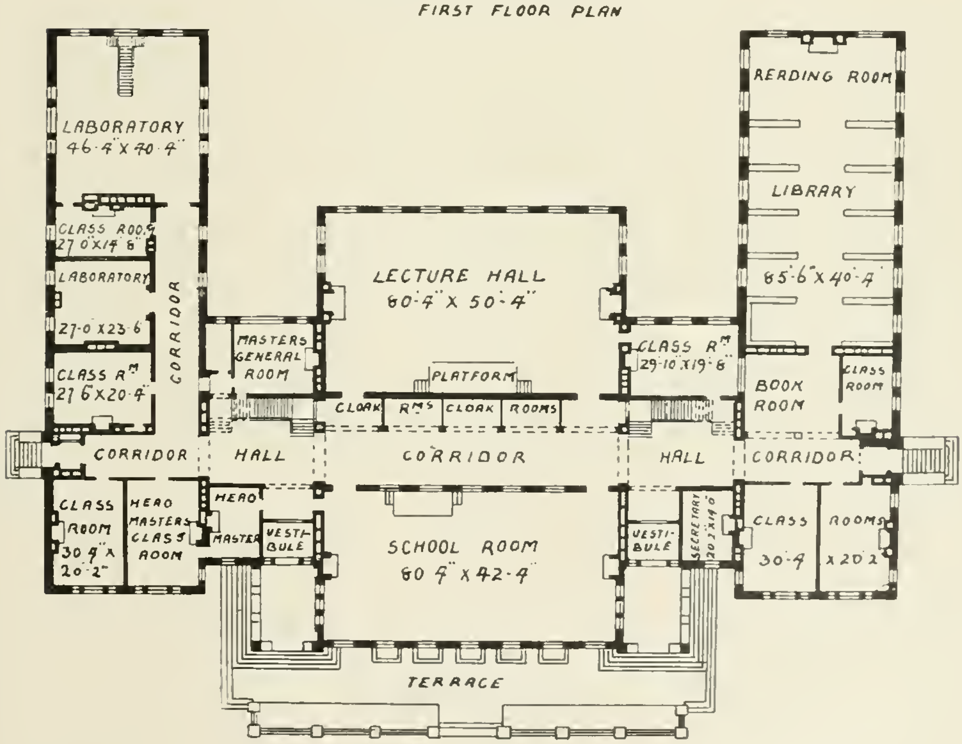
160-163. THE BRIGHTON HIGH SCHOOL, BOSTON, U.S.A.

E. M. Wheelwright, Architect.

Secondary School of the present day, so that the comparison between American school buildings and those of this country has been discussed at greater length when dealing with the Elementary Schools of the two countries (see pages 364 *et seq.*).

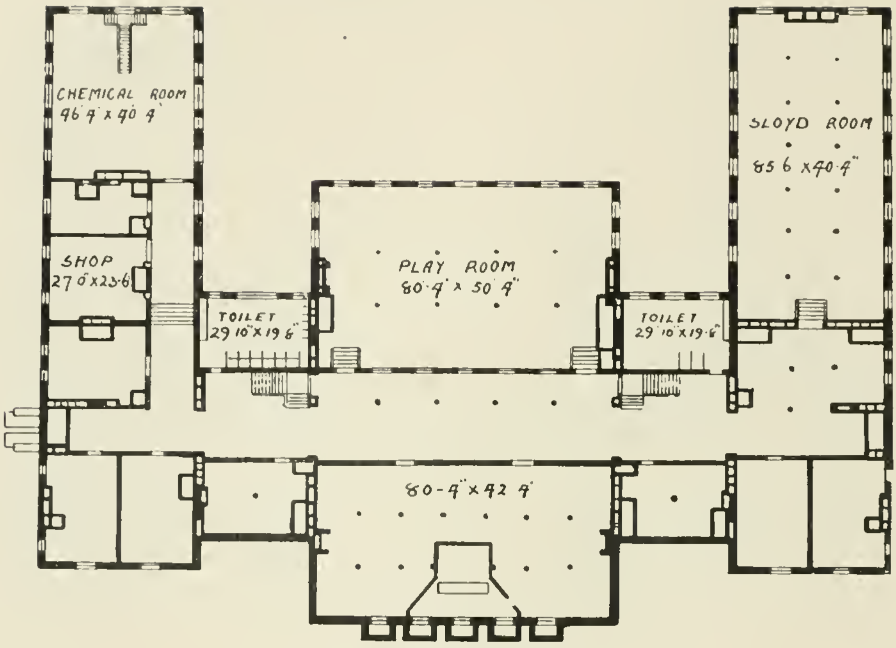


FIRST FLOOR PLAN



GROUND PLAN

164, 165. The Groton School, U.S.A.



166. The Groton School, U.S.A.

For further examples of Day Schools, see—

The figures in large type refer to volumes, the others to pages.

The Builder.—38, 600; 39, 262; 40, 340, 402; 41, 296; 43, 789, 283, 554; 45, 684; 49, 621; 50, 370, 672; 53, 345; 54, 433; 56, 318; 57, 64, 428; 58, 12; 59, 250; 61, 331: 64, 215, 448; 66, 464, 482; 67, 42; 68, 185, 331; 70, 471; 74, 319, 320, 419; 75, 316: 77, 40: 78, 266, 634.

The Building News.—38, 10, 190, 340, 598: 40, 202, 264, 328, 360; 43, 683; 44, 750; 48, 970; 50, 327, 782; 51, 1020; 52, 44, 474; 57, 658; 58, 306, 758; 61, 106, 511; 62, 369; 64, 799; 65, 69, 839; 66, 325; 69, 11, 557; 71, 663; 72, 129, 485, 559; 73, 149, 329, 718, 756; 75, 355, 375, 571; 80, 798.

The British Architect.—52, 6: 54, 273.

Girls' Schools.

The Builder.—38, 417, 451; 40, 773; 41, 388; 42, 578; 44, 810; 46, 606; 71, 140; 73, 328; 76, 92; 80, 491.

The Building News.—42, 760; 44, 788; 57, 178, 179, 484; 59, 356; 61, 462; 63, 753, 769; 64, 685; 71, 223; 74, 60; 79, 323; 81, 10.

Chapter VIII.

PUPIL TEACHERS' CENTRES AND TRAINING COLLEGES.

Pupil Teachers' Centres—Great Want of Suitable Arrangements—Use of Secondary Schools—London P.T. Centres—Training Colleges—General Treatment—Convenient Size — Accommodation required — Hostels — Class-rooms for Criticism Lessons—The Maria Grey Training College—Offord Road Pupil Teachers' School—The Froebel Training Institute—German Training Colleges, and their Features—List of Accommodation provided—The Training College at Pyritz—The Catholic Seminary at Magdeburg—American Normal Schools—School at Salem, Massachusetts.

The dearth of efficiently trained teachers for the Elementary Schools has raised the question of Training Colleges and Pupil Teacher Centres to one of the most important educational questions of the day. The want of teachers is being continually more felt, owing to the decrease in the size of the classes and the fact that the separate class-room system requires a properly trained teacher for each class in the school.

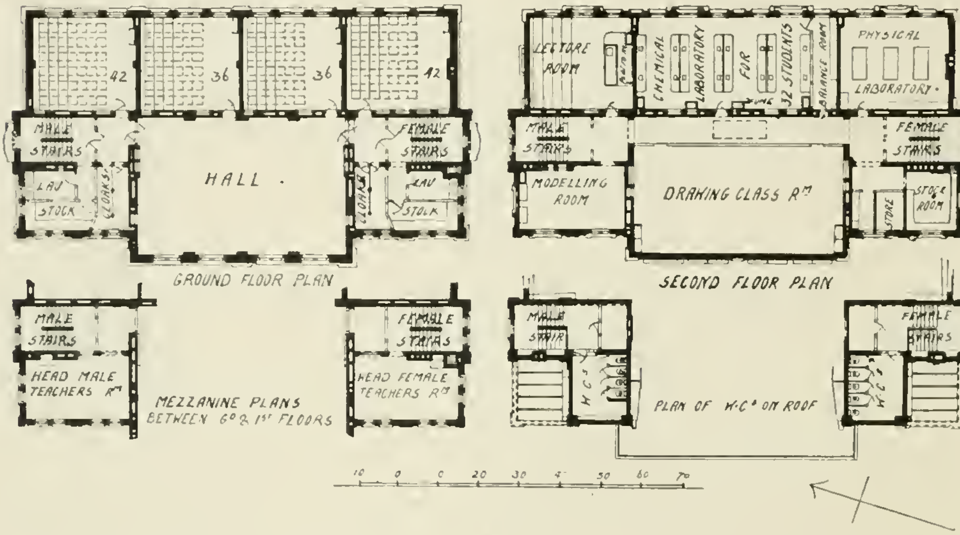
The Local Authorities, recognising the urgency of this need, have tried every expedient, and have been ready to accept almost any arrangement, however inconvenient, that could be made to serve temporarily for the purpose. Classes for P.Ts. have been opened in any buildings that could be procured, such as Methodist Sunday Schools, old School Board Offices, rooms in a Technical Institute, and so on, pending the erection of suitable buildings or some permanent scheme for meeting the want.

In many cases the necessary accommodation has been found in some existing Secondary School. This is also in many ways the most satisfactory method of meeting the difficulty; and as far as the candidate pupil teachers and the preparatory classes are concerned, the advantages of their absorption into a Secondary School are great. The pupil teachers also gain so much by mixing in the wider outlook of a good Secondary School, that this far outweighs the inconvenience caused by

their half-time attendance. Various methods are being tried to meet this difficulty by making them attend alternate weeks or months.

A further advantage of the Secondary School is that the pupil teachers thus get the advantages in buildings, equipment, and teaching staff that could not be supplied except in the case of a very large centre where the pupil teachers only have to be considered.

A further method for dealing with the pupil teachers in outlying districts is to gather them in small boarding-houses or hostels at convenient centres. As far as the buildings are concerned, a pupil teacher centre can be simply regarded as a Secondary School, and planned upon the same lines. An example is given in Figs. 167, 168 of a pupil



167, 168. PUPIL TEACHERS' CENTRE, OFFORD ROAD, FINSBURY.

The London School Board. *T. J. Bailey, Architect.*

teacher centre for 320, of the type erected by the late School Board for London. It is however likely, now that Secondary and Elementary instruction are in the hands of the same body, that special schools of this kind will tend to disappear in favour of the larger life, wider interests, and fuller training of the Secondary School.

There is the question of accommodation to be considered as affected by the question of the fact that the pupil teachers spend half their time working at the centre and half teaching in an Elementary School. As far as this is completely carried out, the centre will of course suffice for double the nominal accommodation, but it must be remembered that occasionally all the pupils may be there say one day a week.

It is perhaps not too much to hope that, as the supply of teachers increases and the necessity of employing pupil teachers becomes less pressing, this system of half-time, which throws a great strain on the young teacher, and which is peculiar to this country, will cease to exist.

Training Colleges.—It is hardly possible, nor indeed is it desirable, to lay down any definite rules as to the plan and arrangement of a Training College. These institutions vary so widely in their needs and circumstances, in their aims and the class of students for which they are intended, that it will be only possible to indicate generally the principles upon which their treatment should be based. In the case of such an institution as the London Day Training College now in process of erection by the London County Council, where no academic teaching is to be given, there will be no need for the class-rooms, laboratories, &c., of the ordinary school type, their place being taken by large lecture-rooms capable of seating 50 to 100 students. Ample provision is also made for common rooms, libraries, &c. A fully equipped Training College is as a rule residential, and has not only to provide suitable boarding accommodation as well as the necessary class-rooms, lecture-rooms, and laboratories for the pupils, but has also to find suitable premises for the model or practising school, which as a rule forms an integral part of a Training College. In many cases, of course, the schools in the neighbourhood supply the necessary opportunity for practical work. The most suitable and economical size for a Training College is somewhere about 100-120. The course usually extends over two years, and, as there are about the same number of students in each year, this makes it possible to divide the College into two lots of from 50 to 60. This is a convenient size for one teacher to take when giving instruction that can take the form of lectures, and also can be suitably divided again into classes of 25 to 30 for certain subjects.

A Training College for 100 students should, if possible, be provided with the following accommodation:—

Dormitories, fitted with cubicles for the full number, with suitable accommodation such as would be found in a good Secondary School,* or there may be a number of single or double study bedrooms.

Recreation-rooms.

Study-rooms.

Library.

Dining-hall.

Rooms for Staff, Principal, &c.

Two lecture-rooms, each capable of taking the students of a year.

Four class-rooms for 25 to 30, one of which should be of fair size, and arranged for a criticism-room.

Physical and chemical laboratories, lecture-rooms, studies, &c.

* See page 205.

In the case of smaller Colleges, it is possible to do with rather less in the way of accommodation ; two class-rooms in addition to the lecture-rooms would be sufficient, as the lecture-rooms could be used for part of the class that was divided.

It is possible, again, in a small institution to make use of the dining-room as a recreation-room or study-room, but the recreation-rooms and study-rooms taken together must provide room for all the students in the College. This rule should be observed even though the students are supplied with study bedrooms.

The scheme of the building generally should be based upon that of a College rather than upon that of a school ; that is to say, careful provision should be made for private study, hours of recreation, opportunities of social intercourse, &c., for the students.

The plan of providing extra residential accommodation for a Training College by means of hostels is becoming widely adopted. These hostels may take the form of specially built boarding-houses, or commonly are ordinary domestic residences that happen to be situated conveniently near the College. In the latter case great care should be exercised to make the arrangements healthy—at least 800 cubic feet should be secured for each occupant in the bedrooms; the low attic rooms usually found should not, if possible, be used. As in such houses it is customary to put more beds in than would be the case in ordinary use, some additional means of ventilation should be provided, unless the windows are carried unusually high up and made to open at the top.

Extra baths are required usually, and in almost all cases extra W.Cs., as the house is being occupied by a much greater number of inmates than it was originally designed for.

In the case of study bedrooms there should be not less than 100 sq. ft. of floor space per head, and 1000-1200 cubic ft.

If the house is sufficiently near the College, the students who sleep there will be able to use the College rooms and have all their meals there, using the hostel merely for sleeping. Otherwise there will have to be the necessary rooms provided for dining, recreation, and work. It is possible to use two rooms, say the dining and another room, which will serve for the three purposes of dining, study, and recreation.

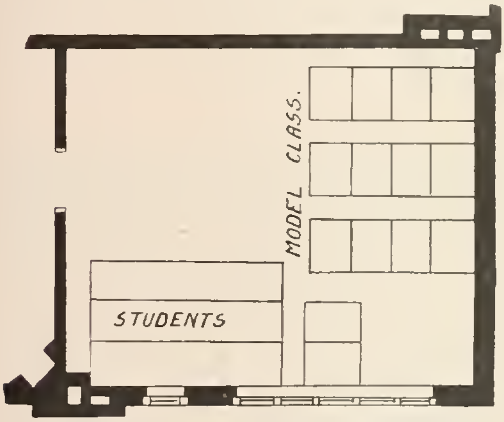
It is usual in a Training College to provide a house for the Principal, forming part of the College buildings. Suitable accommodation is also required for the head of a hostel.

Class-rooms for Criticism Lessons.—In schools or colleges

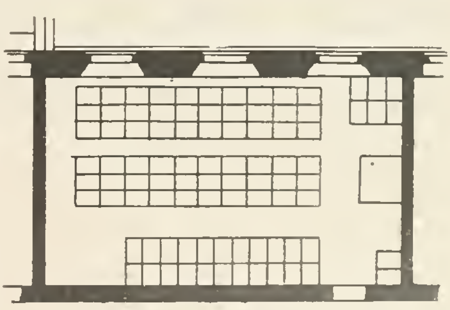
171-174. THE MARIA GREY TRAINING COLLEGE

J. Osborne Smith, Architect.

for training teachers it is necessary to have at least one room arranged for the purpose of criticism lessons. This is arranged with two blocks of desks, at one of which sit the students, *i.e.*, teachers in training, at the other the model class which is to receive the lesson. One of the student teachers, already selected, has to give a lesson to this class, which lesson has of course been previously prepared. At the end of the lesson the model class is dismissed, and various students are called upon to criticise the lesson just given. The master then sums up, criticising both the lesson given and the criticisms made. What is required for this purpose is, firstly, that every one, both the class taught and the students looking on, should be able to see the blackboard clearly. The students should all be able to have a good view of the class taught, to be able to see how far they are following the lesson, and naturally the master must be able to see everything well. A class-room arranged for the purpose of a criticism lesson is shown in Fig. 169. It is quite admissible in such a room to admit light from the back of the students, as the fact of their sitting in their own light is not of any importance. They have not to read nor to write, except perhaps for the purpose of making a few notes, and the light coming from behind them lights the class and blackboard well. It is sometimes thought desirable that the students watching the lesson should not be placed too much in view of the class; this can be managed when the number of students is small. Fig. 170 shows a class-room from a German Training School.



169. A "CRITICISM" CLASS-ROOM.
From a School by J. Osborne Smith.


170. A CLASS-ROOM FROM A GERMAN TRAINING SCHOOL.

In Figs. 171-175 is shown as an example *The Maria Grey Training College.* This is for the instruction of women teachers. There is accommodation in this building for about fifty students and

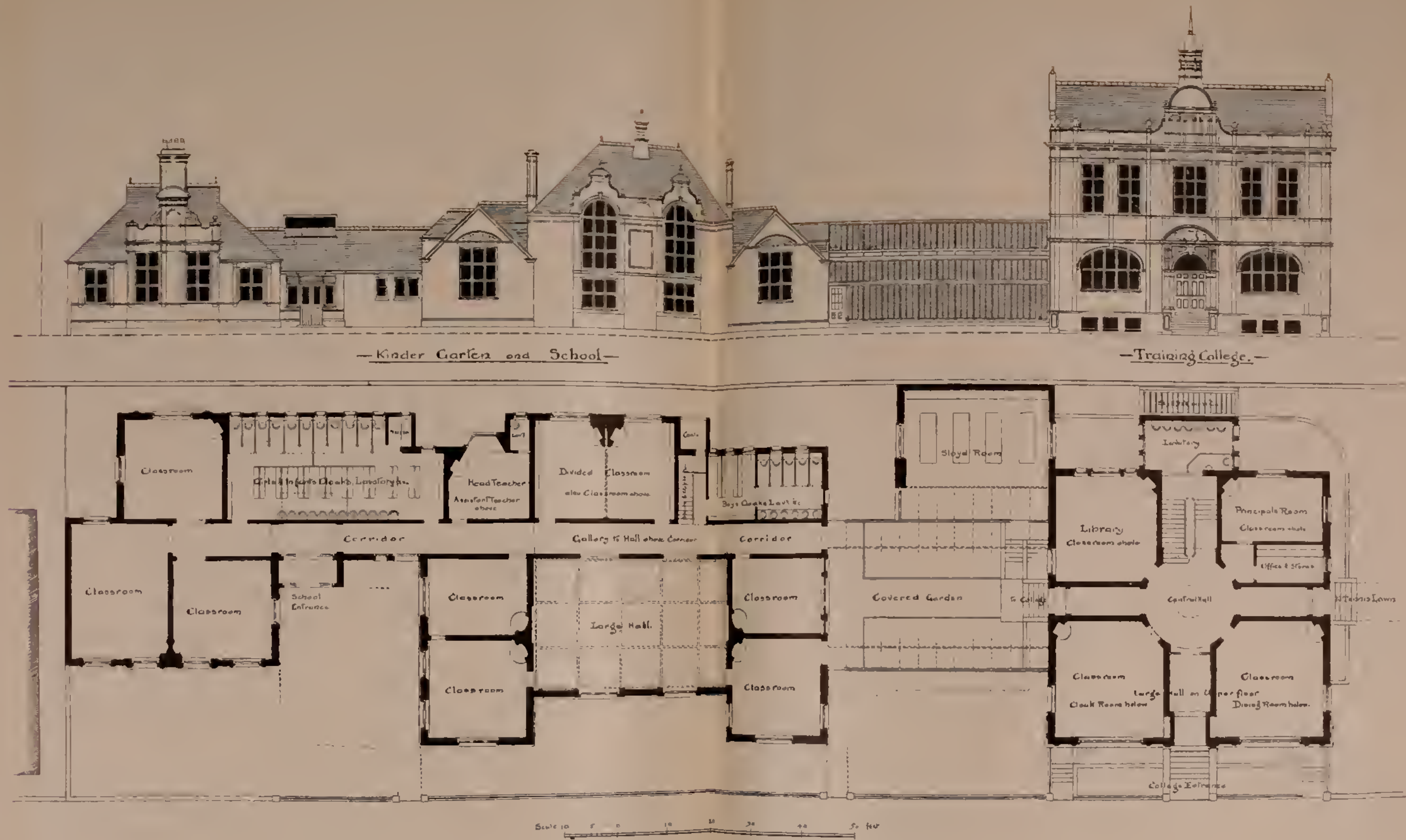
the Model School. It is a Day School, but a hostel for residence in connection with it has recently been opened. The work in the school is divided into three departments—Higher, Lower, and Kindergarten. The plan provides separate entrances for pupils of the Model School and for the students, with separate cloak-room accommodation, which, with the dining-room, library, and kitchen, takes up the basement. On the first floor and other floors are found the class-rooms and the assembly hall. At the top are placed the chemical laboratory, studio, and music-room.

175. The Maria Grey Training College.

J. Osborne Smith, Architect.

The Froebel Training Institute, West Kensington (Fig. 176). This consists of a college for the students connected with the school and Kindergarten by means of a covered garden, each part being complete in itself. The school is arranged with a hall and eight class-rooms, one of which, of considerable size, is divisible by a partition. This serves for the Kindergarten room, and being just opposite the hall, the children can easily go there for their marching games and exercises.

Practising School, Saffron Walden.—Figs. 177-179 show the arrangement of a Practising School attached to a Training College at



176. THE FROEBEL INSTITUTE, WEST KENSINGTON.

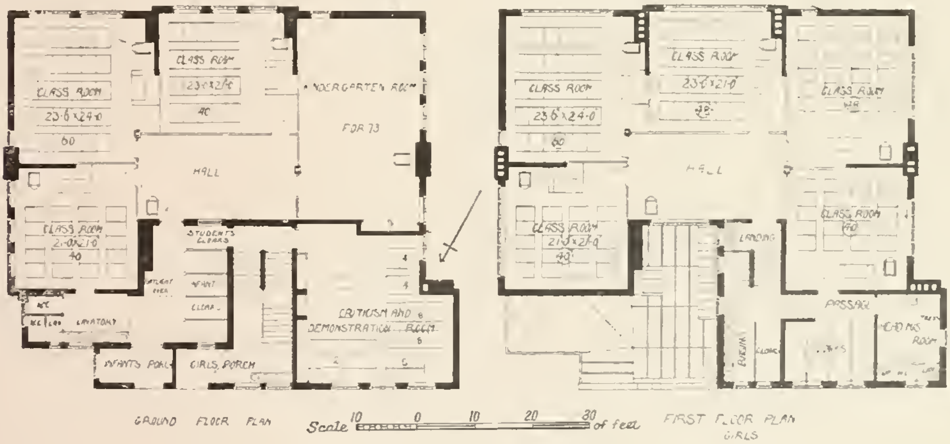
J. S. Quilter, Architect.

Saffron Walden. On the ground floor is accommodation for 220 infants, arranged in four class-rooms separated from a central hall by

177. Practising School, Saffron Walden.

The British and Foreign School Society. *J. Osborne Smith, Architect.*

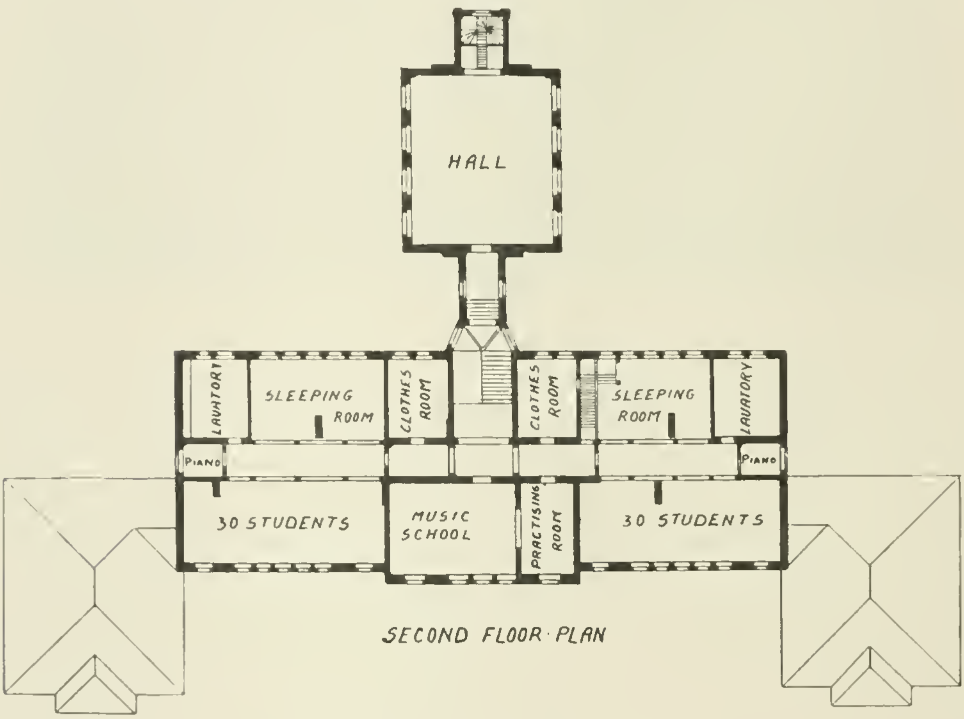
movable glass partitions; these rooms are so arranged that when these partitions are in their places the mistress in the centre can see what is going on in each room; when they are folded back the whole floor



178, 179. Practising School, Saffron Walden.

becomes practically a large floor. A similar arrangement on the first floor takes 228 girls. A view of the exterior is shown in Fig. 177.

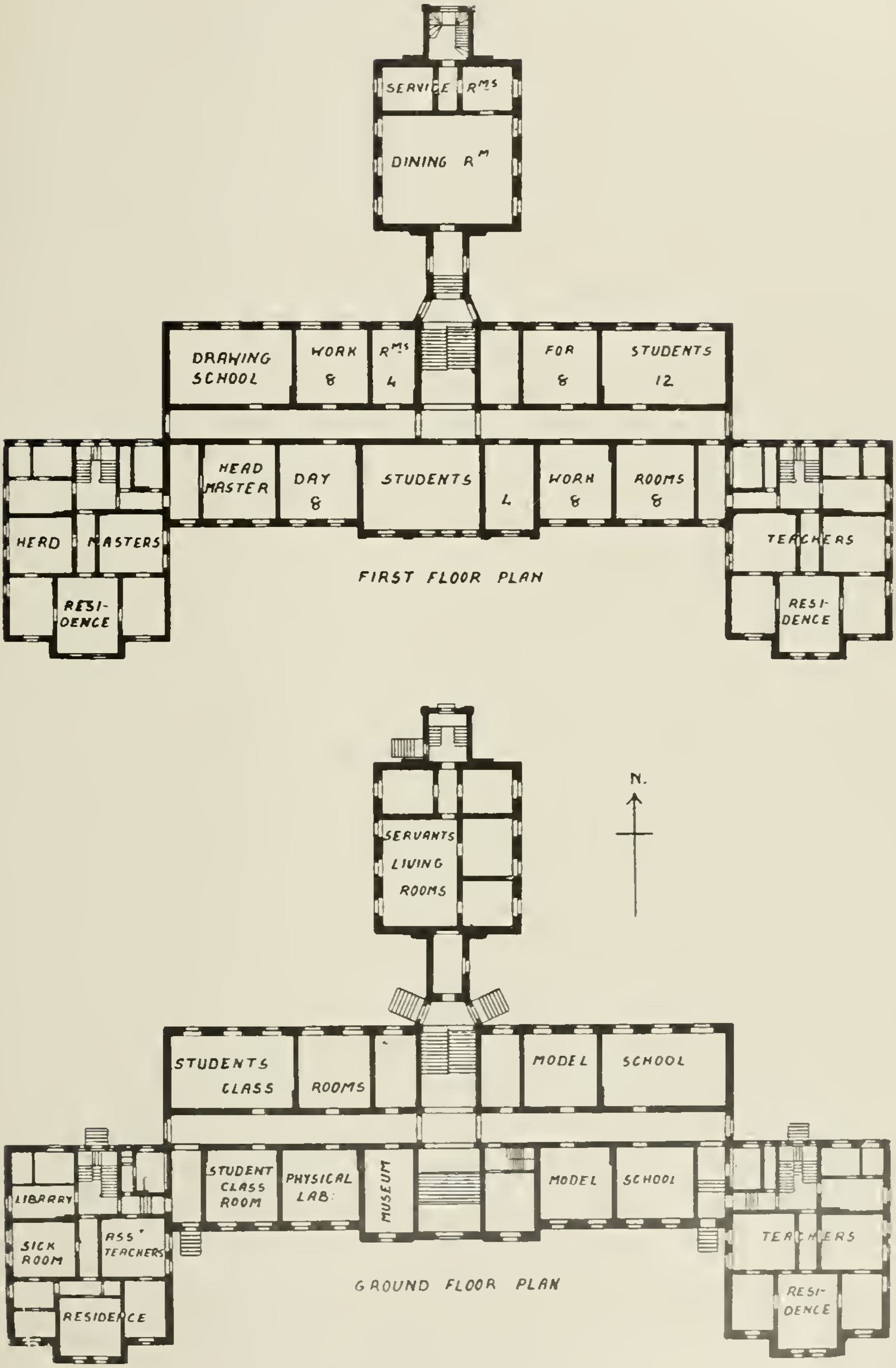
German Training Colleges.—Training Colleges in Germany occupy a far more important part in the educational system, especially with regard to teachers for Secondary Schools, than in this country, so that it may be of value to give a brief account of their arrangement. In most respects they are organised in much the same way as those in this country, combining a College where the students receive instruction in the theory and practice of teaching with a Practising School in which they can put into actual practice what they have learnt, and also themselves continue to work at subjects of general culture. Although



180. Training College at Pyritz.

most of these institutions are similar in their general organisation and studies pursued, there is a wide difference in the time given to the course, which varies from a two to a six years' course in different institutions, and again in the actual arrangement of study. As the office of teacher is often closely connected with the Church, so music-teaching, especially the use of the organ, plays an important part. In recent times a good deal of time has been given to gymnastic training.

The Training Colleges are either residential, or Day Schools, the students living in the neighbourhood, or more often a combination of the two. In Würtemberg, Baden, &c., residential Training Colleges are



181, 182. Training College at Pyritz.

the more usual. In Prussia, Saxony, and other States it is common to find the combination of day and boarding establishments.

The Training Schools (Seminarschulen), in which the pupils learn both the theory and practice of education, have in most States, Saxony, Würtemberg, Prussia, &c., a three years' course, in Bavaria only two. The number of students in training is on an average from 75 to 100, so that the classes to have a three years' course would vary from 25 to 30, or for collective purposes 50 to 60. Where the numbers are greater, the classes would be split into parallel forms. The Practising or Model Department generally consists of a school of four classes. In addition to this there is attached to many of these institutes a Preparatory School or Proseminar, which prepares younger scholars for entry into the Training College. This may be either a separate institute, or be included in the same building as the Seminar. These Preparatory Schools have as a rule three, sometimes four, classes. If required by the condition of the neighbourhood in which it is placed, more classes would be added.

The following list gives the rooms that are usually provided*:—

For the school part of the building:—
- For the students' training, the class-rooms necessary according to the number of students and length of the course.
- Studio.
- Chemical and physical laboratories.
- Library.
- One or more rooms for special collective purposes.
- Rooms for music-teaching.
- Hall (containing the organ if there is one).
- For men students, a manual training room.
- Women students, a room for domestic economy training.
- Director's room.
- Teachers' common room.
- Cloak-rooms, lavatories, &c., and recreation-room for the students.
- Sometimes a guest-room for visitors and inspectors is added.
- For the Practising School, the necessary number of class-rooms (usually four), cloak-rooms, lavatories, &c.
- And common to the Training School and Practising School, rooms for the teaching and practice of gymnastics.

Gardens and playgrounds.

In the case of residential colleges:—
- Living or work room.
- Sleeping-rooms, lavatories, bath-rooms, and clothes-room.
- Sick-rooms, reception-rooms, rooms for linen.
- Dining-rooms, kitchens, &c.
- Stores, &c., for the boxes and property of the students.
- Director's private living-room, and the necessary accommodation for servants, yards and gardens. This part does not materially differ from the requirements of an ordinary Boarding School.

* Handbuch der Architektur.

A good example is the Training College at Pyritz,* given in Figs. 180-182. This building is intended to accommodate 60 residential and 30 day students. The centre block of the building is arranged for school purposes, the living-rooms of the Director and the assistant teachers being the two wings, while in the projecting wing at the back is arranged the kitchen, with the dining-room immediately over. The Practising School consists of the usual four class-rooms on the ground floor, where are also the students' class-rooms and the physical laboratory. The first floor, except for the studio, is taken up by the students' day-rooms or work-rooms, while on the top floor are the dormitories and music-rooms.

As a further example of a large German Training College there is shown the new Catholic Institution recently erected at Bautzen; see Figs. 183-186. The building is intended to take 100 residential students, and cost about, exclusive of the furniture, £28,350. The class-rooms, intended for classes of 25, provide rather over 300 cubic ft. per head, the living-rooms about 450, and the dormitories 700 cubic ft., the rooms being about 14 ft. high. The plan of the building is arranged to allow subsequent enlargement to be easily carried out. It consists of a centre block with the wings projecting to the back; in the left wing is the entrance to the Practising School, in the right the Principal's house. The building covers an area of about 3,370 sq. ft., and has four floors. The plans with the list of numbered rooms will show the arrangements of the building.

American Training Colleges.—In the United States the Training Colleges are called "Normal Schools," and are as a rule State institutions. The fully developed Normal School has class-rooms for Kindergarten, primary and grammar grades, with entrance and toilet rooms distinct from those for the students. For the latter there is an "assembly" or "study room" with single desks and chairs for a maximum of 250 students, and special rooms for instruction in geography, mineralogy, zoology, history, literature, pedagogy, and languages. There are also physical, botanical, and chemical laboratories, and rooms for instruction in drawing, music, and manual training. In addition a good-sized library and gymnasium are considered essential features. In Figs. 187-190 is shown the State Normal School at Salem, Mass., taken from Mr Wheelwright's "School Architecture." In the basement, besides the heating and ventilating apparatus, are the toilet and play rooms for the pupils of the Model or Practising School, a large gymnasium and dining-room, a lunch-room and store-room.

* Handbuch der Architektur, Band IV.

BASEMENT.

1. Servery.
2. Corridor.
3. Kitchen.
4. Scullery.
5. Fresh-air supply.
6. Warming room.
7. Maids' room.
8. Coal cellar.
9. Larder or store cupboard.
10. Caretaker's W.C.
11. Cellar.
12. Wash-house.
13. Laundry.
14.–17. } Caretaker.
18., 19. } Offices for students.
20. Ashes and dust-room.
21. Boiler.
22. Engineer's room.
23. Cleaning-room.
24. Teachers' store-room.
25. Manual instruction room.
26. Stationery store.
27. Shower bath.
28. Undressing-room.
29. Baths.
30.–32. } Offices for Principal's house.
33. Engineer's W.C.

GROUND FLOOR.

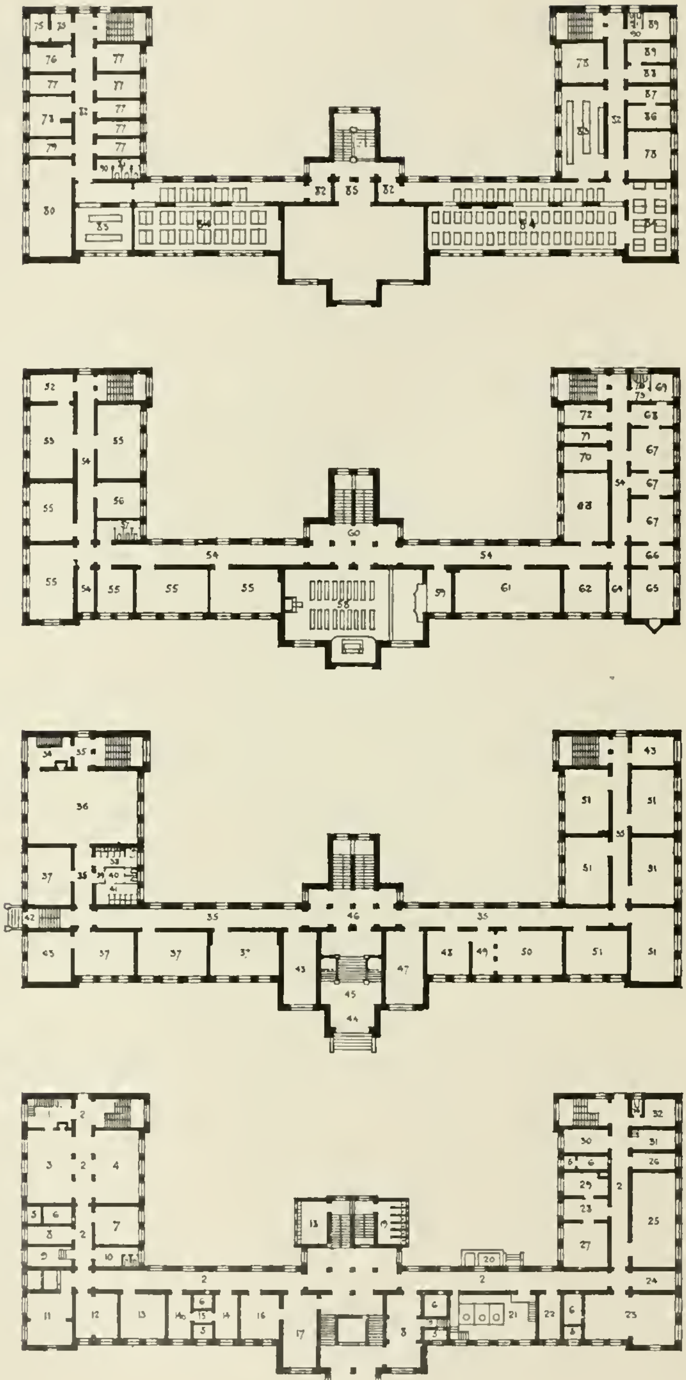
34. Servery.
35. Corridor.
36. Dining-hall.
37. Practising School class-rooms.
38.–41. } Offices, &c., for Practising School.
42. Entrance to Practising School.
43. Criticism-room.
44. Porch.
45. Vestibule.
46. Main staircase hall.
47. Teachers' room.
48. Apparatus.
49. Preparation-room.
50. Physical laboratory.
51. Class-room.

FIRST FLOOR.

52. Model-room.
53. Drawing school.
54. Corridor.
55. Living-room.
56. Inspection-room.
57. Teachers' offices.
58. Hall.
59. Bellows-room for organ.
60. Main staircase landing.
61. Common room.
62. Conference-room.
63. Library.
64. Secretary's room.
65. Principal's room.
66. Waiting-room.
67, 68, 69, 70, 71, 72, 73, 74.—Principal's living-rooms.

SECOND FLOOR.

75. Violin teaching room.
76. Organ ,, ,,
77. Piano ,, ,,
78. Locker-room.
79. Bellows-room.
80. Music-hall.
81. Offices for dormitories.
82. Corridor.
83. Lavatories.
84. Dormitory.
85. Gallery in hall.
86., 87. } Assistant masters' rooms.
88. Nurse's room.
89. Sick-room.
90. Lobby.
91. Offices.

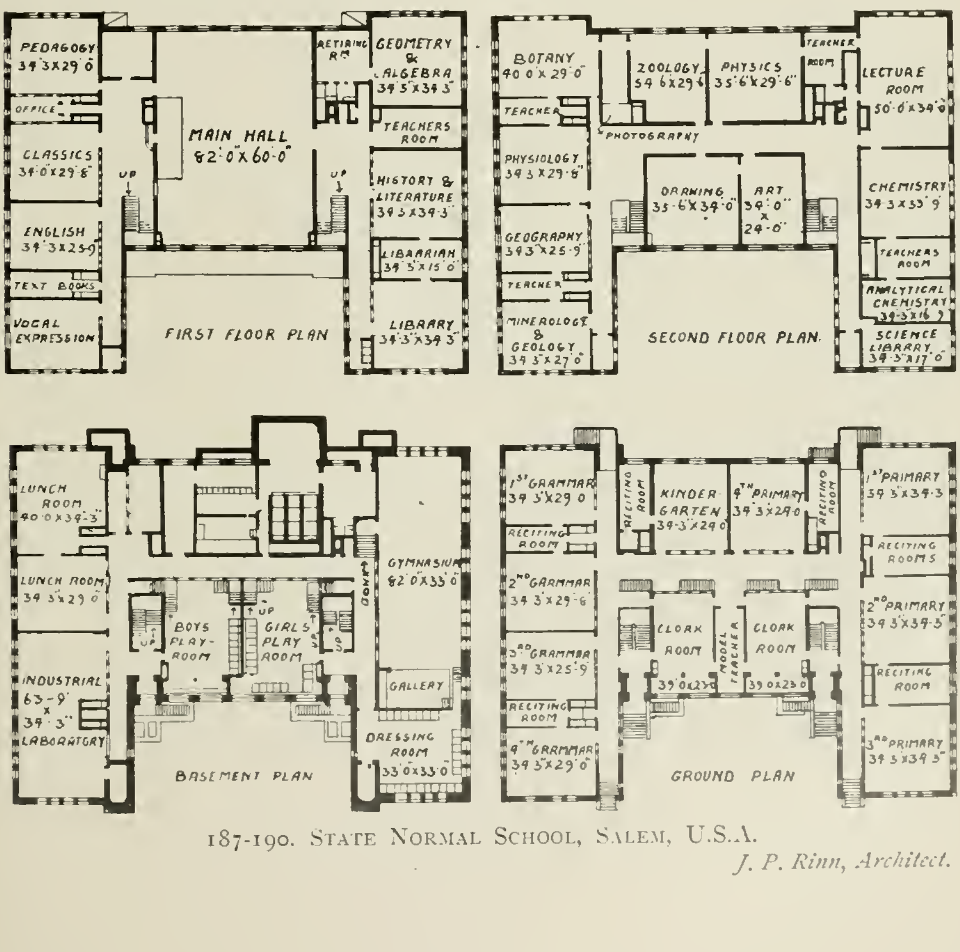


183-186. TRAINING COLLEGE, BAUTZEN.

From Das Schulhaus, 1904. *Bauman, Architect.*

On the ground floor are toilet and cloak rooms provided with individual lockers for the students of the Normal School, for whom there are two outside entrances. In each wing are the entrances to the Model School, for which nine class-rooms are provided entirely distinct from the Normal School. On the first floor is the assembly hall, 60 by 85 ft., with the principal office, reception-room, teachers' meeting-room, with toilet-room, library, supply, recitation, and work rooms.

The second floor is chiefly given up to science instruction, and besides the special rooms devoted to the various subjects there is a lecture-room with the seats arranged in tiers. There are also two rooms for drawing on the north side. The school, as is almost always the case in American Schools, is a Day School. The Model School is sometimes found in a separate building. Sometimes a neighbouring school is utilised for the purpose of practice. The American Normal Schools and Training Colleges are built usually on a very liberal scale, and are very fully-equipped and well-arranged buildings.



187-190. State Normal School, Salem, U.S.A.

J. P. Rinn, Architect.

CHAPTER IX.

BOARDING SCHOOLS.

Two Classes of Boarding Schools—Preparatory Schools—Questions arising in Boarding Schools—List of the Accommodation of a Large Boarding School—Schools with separate Boarding Houses—Different Ways of dealing with the General Scheme—Quadrangles or Separate Blocks of Building—Objection to the Quadrangular System—The New Buildings for Christ's Hospital, Horsham—Comparative Survey of three of the Designs in the Competition—The Royal Masonic Institution for Boys, Bushey, illustrated and described—School Blocks in a Large School—Kitchens and Offices.

Boarding Schools fall practically into two classes. In the first are the schools arranged with a central block, containing what are generally called the school buildings, with a number of boarding-houses grouped round, in which the pupils live. In this form are found most of the old Public Schools. In the second are found the schools which are complete in themselves, containing in one block not only the living-rooms for the pupils, but the necessary rooms for educational purposes as well. They are of course smaller schools. Boarding Schools for girls have, with one or two exceptions, been up to the present arranged on this plan, and usually the Preparatory Schools, of which there are such a large number, and which play so large a part in secondary education in this country. These Preparatory Schools are in most cases separate from and entirely independent of the larger schools for which their pupils are being prepared, and to which they will ultimately go. They are usually Private Schools, owned and managed by the Headmaster, and do not keep their boys beyond the age of fourteen or fifteen. These schools are not only peculiar to this country, but of comparatively recent growth. In the introduction to the sixth volume* of the "Special Reports" issued by the Board

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* Preparatory Schools, vol. vi.

of Education it is stated that the first true Preparatory School was probably that founded by Lieutenant Malden in 1837. The large increase in the number of these schools in recent years and the keen competition has resulted in the building of very fully and efficiently equipped schools ; and since their success is usually judged by the number of pupils who win scholarships at the Public Schools, the teaching has to be kept up to a high standard, but with a strong tendency to cramming and specialisation. Some of the large Secondary Schools have Preparatory Schools attached to them, the boys of the two schools being kept separate. In these cases the boys at the Preparatory Schools get the advantage of the use at certain times of the school gymnasium, swimming-baths, &c., which cannot always be supplied by the ordinary Private School, though it is remarkable how very completely some Private Schools are provided with expensive additions of this kind.

The central block of a large Boarding School offers naturally much the same problems in regard to planning as that of a large Day School—that is, as far as the educational requirements are considered. It often happens, of course, that a school begins as a Day School, and eventually, by the growth of residential accommodation in connection with it, becomes a Boarding School. In other cases a small Boarding School becomes the nucleus of a large one, and, remaining as the central block of the school, is still distinguished by some particular name, such as the School House. In the case of the rebuilding of a large school on a new site, as for example the recent moving of Christ's Hospital School from London to Horsham, it becomes possible to treat the whole scheme systematically instead of the somewhat haphazard way in which our older schools have grown up. Various arrangements providing for the more economical working of the school then become possible, such as the provision of a central dining-hall and kitchen for the whole school, the supply of heating for all the buildings from one centre, &c. The arrangements of the large Boarding Schools in this country and the accommodation they provide show so great a variety in so many different forms that it is an almost impossible task to find any points where they can in any way be divided into classes. There are schools to suit every rank of social life, with fees varying from an inclusive charge of £30 or £40 a year up to £150 or £200.

SCHOOLS WITH SEPARATE BOARDING-HOUSES.

Accommodation.—The question of the extent of the accommodation that has to be provided is not an easy one to deal with, owing to the variety of the different kinds of schools. On the whole it has been considered that the best plan would be to give a list as full as possible of the different rooms and buildings that a large first-class Boarding School of the present day is supposed to have. The following list, though not pretending to be exhaustive, will be found to contain most of the rooms that are usually provided. The rooms that belong strictly to the educational block have been discussed previously in dealing with Day Schools, and are only alluded to here in regard to their position in the general scheme of the school.

List of requirements of a large Secondary Boarding School :—

Central Block and Administrative.

Entrance-hall with porter's lodge.
Reception-room.
Board or Committee room.
Headmaster's room.
Secretary's office and clerks' office.
Assistant masters' common rooms.
Luncheon-rooms for Committee and serving-rooms.
Lavatory accommodation for each of the above.
Large dining-hall.*
Serving-rooms.
Assistant masters' dining-room, pantry, &c.
Kitchens.
Sculleries, vegetable sculleries.
Pantries.
Dining-hall for men servants.
Dining-hall for women servants.
Larders.
Store-rooms for groceries, table linen in use, china, glass, &c.
Cellars.
Servants' lavatories and W.Cs.
Cook's sitting-room.
Storekeeper's office.
Head Matron's sitting-room, bed-room, &c.
Assistant Matron's sitting-room, bed-room, &c.
Dormitories for the school servants, box-rooms, &c.
Central store for linen.
Airing-room and soiled linen room, &c.

Educational.

Large school hall with platform, &c.
Class-rooms of different sizes.†
Headmaster's class-room.
Sixth form room.
Studio for drawing.
Studio for modelling.
Studio for mechanical drawing.
Library and reading-rooms.
Museum.

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* This is of course for schools where meals are not taken in the boarding-houses.
† For numbers and sizes, see pages 62 *et seq.*

Natural Science.

Chemical laboratory and store-room.
Physical laboratory and store-room.
Balance-room.
Dark room for optical work.
Dark room for photographic work.
Botany and Biology and Microscope room.
Natural History.
Machinery-room, testing instruments, &c.
Lecture-room for Chemistry and preparation-room.
Lecture-room for Physics and preparation-room.

Music School.

Music-hall.
Music-rooms for pianos, singing, teaching, &c.
Music-rooms for band.
Music practising rooms.*

Separate Buildings.

Chapel.
Gymnasium.
Sanatorium.
Infirmary.
Swimming-bath.
Headmaster's private house.
Assistant masters' houses for those not in control of boarding-houses.
Armoury for rifle corps.
Covered drill sheds.
Carpenter's shop, smith's forge, rooms for bookbinding, printing, turning, &c.
Steam laundry.
School block of W.Cs., urinals, &c.
Pavilions for cricket and football grounds.
Fives courts, tennis courts, racquet and squash racquet courts, &c.

Boarding-Houses.

Dormitories or cubicles.
Prefects' or monitors' cubicles in dormitories.
Day-room, sometimes an additional one of smaller size, for some of the older boys.
Studies.
Sitting-rooms and bedrooms for assistant masters as required.
Box-room, linen and clothes room.
Locker-room with locker for every boy.
Boys' boot-room, airing-room, and drying-room.
Furnace-rooms, boot-cleaning, coal, wood, &c.
Room for games clothes.
Ward and store room for linen.
Night W.Cs., and bathrooms near dormitories.
Lavatory with wash-hand basin for each pupil.
If there is no central dining arrangement, a dining-room and necessary kitchen arrangements must be found in each house.
Matron's room, store-rooms, &c.
Sick-rooms.
Servants' rooms.

The above list will give some idea of the great number and variety of rooms that go to make up the modern large school.

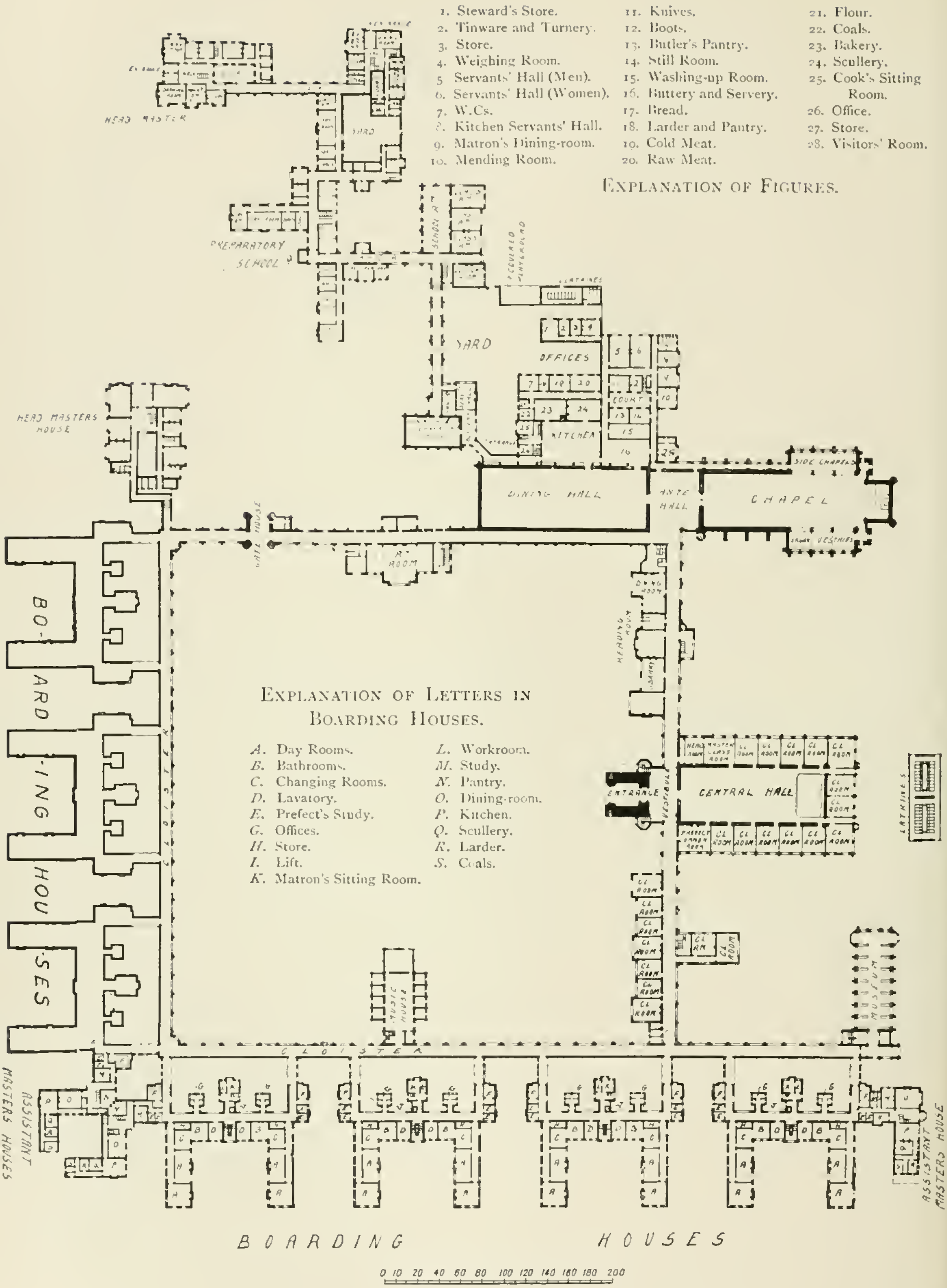
The problem of how to combine all these rooms and buildings so as to form a school can be approached in two ways. Either a reproduction can be made in some form, modified to suit modern requirements,

* In Girls' Schools it is usual to provide a much larger number of music-rooms than is necessary for a Boys' School.

of the old quadrangular arrangement, on the lines of the old colleges and other mediæval seats of learning, with an entrance gateway, the hall, chapel, and other rooms grouped round one or two quadrangles; or, on the other hand, the school may be more or less broken up into separate blocks. At first sight the former plan seems much the more attractive. It offers splendid opportunities for architectural effect; it has all the force of tradition behind it; and there is also little doubt that it offers the easiest solution of the best way to secure a compact plan—a school that shall be easy to supervise and economical in working. In spite, however, of the many and great advantages of such a method of planning a large school, it has in recent years met with less favour, the reasons against it being based on the questions of health. There is, it is argued, in such an arrangement bound to be a considerable portion where the air is to a large degree stagnant, and upon which the sun cannot have fair play. Where the quadrangle is of great size, as in the case of a large school, and the buildings not very high, this objection would probably not be a very strong one; but at the same time, where buildings are arranged more or less symmetrically on the sides of a square, it is hardly possible to provide a suitable aspect for all the rooms. Another point in this connection should be noted, that while the quadrangular arrangement is perhaps suitable for the purpose of a college where there have to be a great number of staircases with small sets consisting of two or three rooms, it is not as well adapted for a school where boys are housed in blocks of 50 or 100. This point has been shown well in the recent competition for the new buildings for Christ's Hospital, recently completed at Horsham, in which case the winning design—that sent in by Sir Aston Webb & Mr Ingress Bell—is arranged on the system of separating the residential portion into separate blocks, while the school (or educational) buildings are combined into one quadrangular block. This particular scheme, whether considered from the point of view of health and sanitary science or from that of the easy and economical working of the school, has met the difficulty of providing for the large numbers most successfully. It is interesting to compare with it the competition design of Messrs Carpenter & Ingelow, illustrated in Fig. 193, who have planned their building on the quadrangular method, in which style of school planning they have had much experience. Their plan too serves as an excellent example of what can be done in that method of planning a school. A third design, in which the buildings are arranged in an irregular group, is also illustrated—the design submitted by Messrs Paley & Austin. These three

191. NEW BUILDINGS FOR CHRIST'S HOSPITAL, HORSHAM.

Sir Aston Webb & Mr Ingress Bell, Architects.



EXPLANATION OF FIGURES.

1. Steward's Store.
2. Tinware and Turnery.
3. Store.
4. Weighing Room.
5. Servants' Hall (Men).
6. Servants' Hall (Women).
7. W.Cs.
8. Kitchen Servants' Hall.
9. Matron's Dining-room.
10. Mending Room.
11. Knives.
12. Boots.
13. Butler's Pantry.
14. Still Room.
15. Washing-up Room.
16. Buttery and Servery.
17. Bread.
18. Larder and Pantry.
19. Cold Meat.
20. Raw Meat.
21. Flour.
22. Coals.
23. Bakery.
24. Scullery.
25. Cook's Sitting Room.
26. Office.
27. Store.
28. Visitors' Room.

EXPLANATION OF LETTERS IN BOARDING HOUSES.

A. Day Rooms.
B. Bathrooms.
C. Changing Rooms.
D. Lavatory.
E. Prefect's Study.
G. Offices.
H. Store.
I. Lift.
K. Matron's Sitting Room.
L. Workroom.
M. Study.
N. Pantry.
O. Dining-room.
P. Kitchen.
Q. Scullery.
R. Larder.
S. Coals.

195. COMPETITION DESIGN FOR CHRIST'S HOSPITAL.

Carpenter & Ingelow, Architects.

plans have been illustrated together in Figs. 192-194 in order to show comparatively three different methods of dealing with a similar problem, in each one of which the scheme is treated from an entirely different point of view. The new schools at Horsham for Christ's Hospital are, I suppose, the largest school buildings that have been built in this country all at one time, so that the question could be treated as a whole and the entire scheme put in working order at once. The problem set before the five firms of architects who had been asked to compete was no easy one. There were to be boarding-houses to take 700 boys in addition to the Preparatory School, each house to be so arranged that no dormitory or day-room should have more than 25 boys in it. All the dining arrangements were to be in the central hall. No meals of any kind were to be provided in the houses, either for boys, servants, or masters. In the educational part the class-rooms were to be in connection with the school hall, which was to be sufficiently large to take the whole school. The Preparatory School was to be kept separate from the rest of the school, but so arranged that the boys in it could make use of the central dining-hall. There were of course to be also included—Science and music schools, a gymnasium, chapel, &c.

The block plans of the three designs are shown overleaf. The lowest one, Fig. 194—that of Sir Aston Webb & Mr Ingress Bell—shows the building as it is now built. A better idea of it will be gained from the bird's-eye view, Fig. 191. This plan offers a very ingenious and satisfactory solution of the question. The underlying idea of the scheme was to divide the school into two sections—that is, the residential portion and the working portion. In this way, by treating the educational or working buildings as one block, arranged on the quadrangular system, it is possible to so group the buildings that they shall be compact, easily supervised, and economically worked. By breaking up the residential block it has been possible to secure not only a free circulation of air, but a position for every boarding-house in the aspect considered most desirable. The block plan and bird's-eye view together show very clearly the connection between the boarding-houses and the rest of the school. The residential blocks run east and west from the large block of buildings containing the great dining-hall and kitchens, the whole line curving slightly backwards. One of the houses is illustrated and described below.* Underneath all the school buildings, cloisters, and boarding-houses runs a subterranean passage sufficiently large to admit of a

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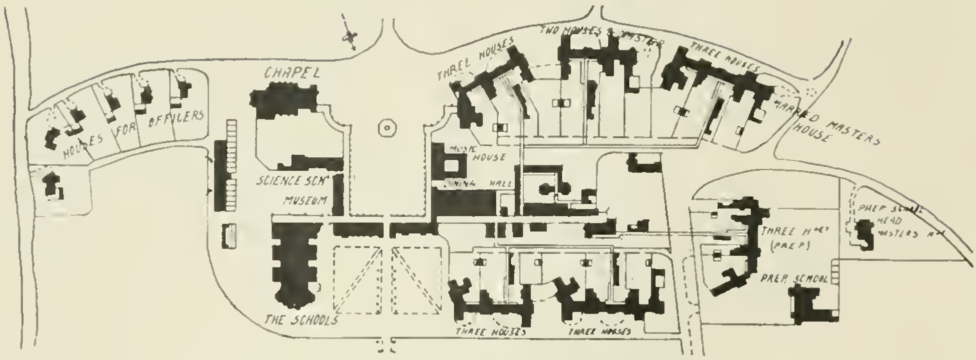
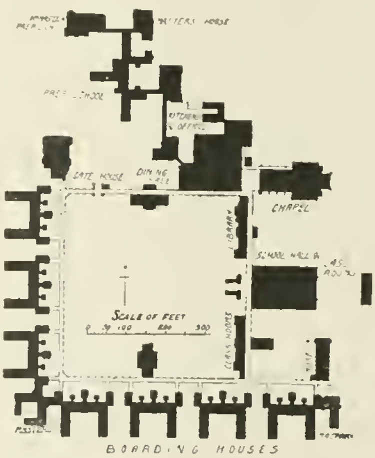
* See page 230.



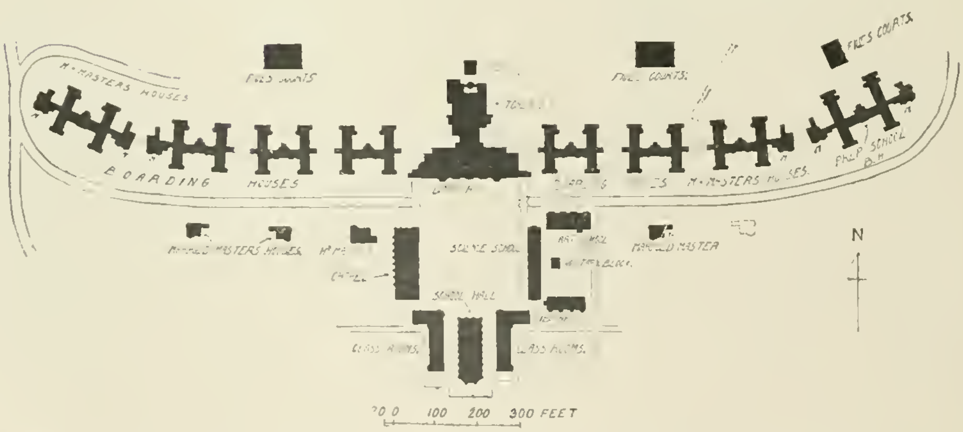
192. Competition Design for Christ's Hospital.

Paley & Austin, Architects.



193. Competition Design for Christ's Hospital.

Carpenter & Ingelow, Architects.



194. Block Plan of Christ's Hospital, New Buildings at Horsham.

Sir Aston Webb & Mr Ingress Bell, Architects.

man walking upright. In this are carried all the hot-water and other pipes, wires, &c., so that inspection and repairs can be made easily. The heating is all done from a station situated at some distance from the school buildings, calorifiers being placed where required. The whole building has been very carefully arranged with everything that can be devised to ensure healthy and sanitary conditions.

The second plan shows the design submitted by Messrs Carpenter & Ingelow, which is a remarkable example of the adaptation of quadrangular system of planning to the needs of a large school. The scheme will be better understood by reference to the larger plan in Fig. 195. The general idea of the arrangement places the boys' boarding-houses on the south and west sides; on the east, the great hall with its class-rooms, the museum and chapel; to the north, the dining-halls, kitchens, and offices, behind these being placed the Preparatory School. All the buildings are connected by the main cloister, so that it is possible to get from any one part of the buildings to any other under cover, while the houses being joined to this covered way by a short passage, it is possible to completely cut off any one of the houses if necessary. The boarding-houses are arranged in blocks of two, each block accommodating 50 boys.

The third design illustrated—that of Messrs Paley & Austin—is not arranged on any exactly symmetrical plan. There is a large court facing south enclosed on three sides by a cloister, bounded on the east by the chapel, science schools, and museum; on the west by the music school and one of the boarding-houses. Entering the school through the clock tower, the educational part, *i.e.*, the school hall, class-rooms, and library, lies on the left or east, while to the right is the residential portion, the Preparatory School being placed on the same side, but farther west. The covered cloister, 15 ft. wide round the great court, enables access to be gained to and from all parts of the school buildings under cover. From each of the boarding-houses, one of which is illustrated below,* leads a corridor of two floors to the main buildings—for school servants below, and for the boys above. The question of aspect has been treated rather curiously in this design, for of the six boarding-houses three face south, the other three being arranged to face due north—an aspect which, although defended on some grounds for class-rooms, cannot be considered satisfactory for residential houses.

The Royal Masonic Institution for Boys, Bushey.—As a further example of the general scheme of a large plan there is illustrated the

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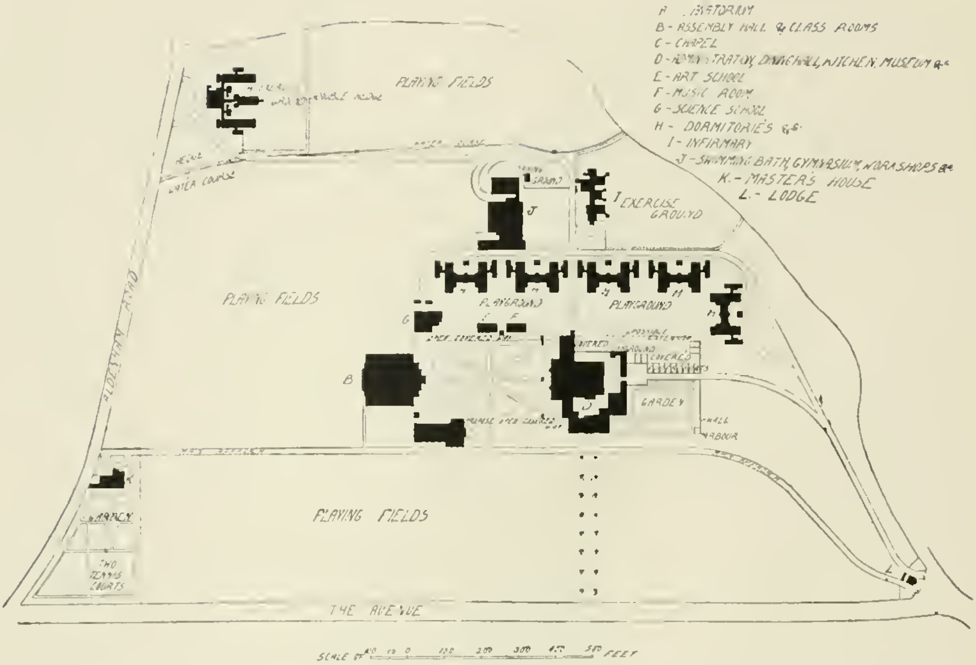
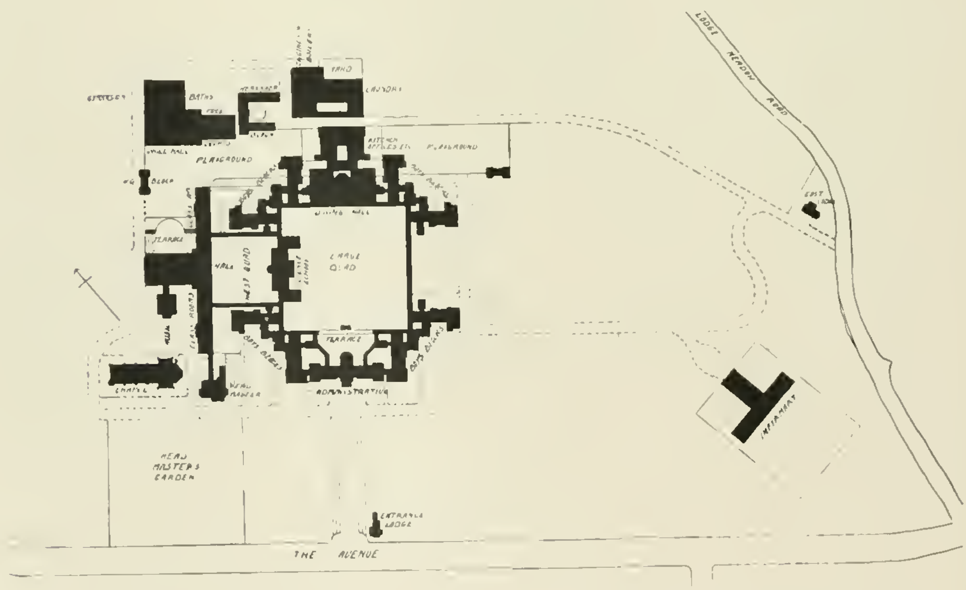
* See page 231.



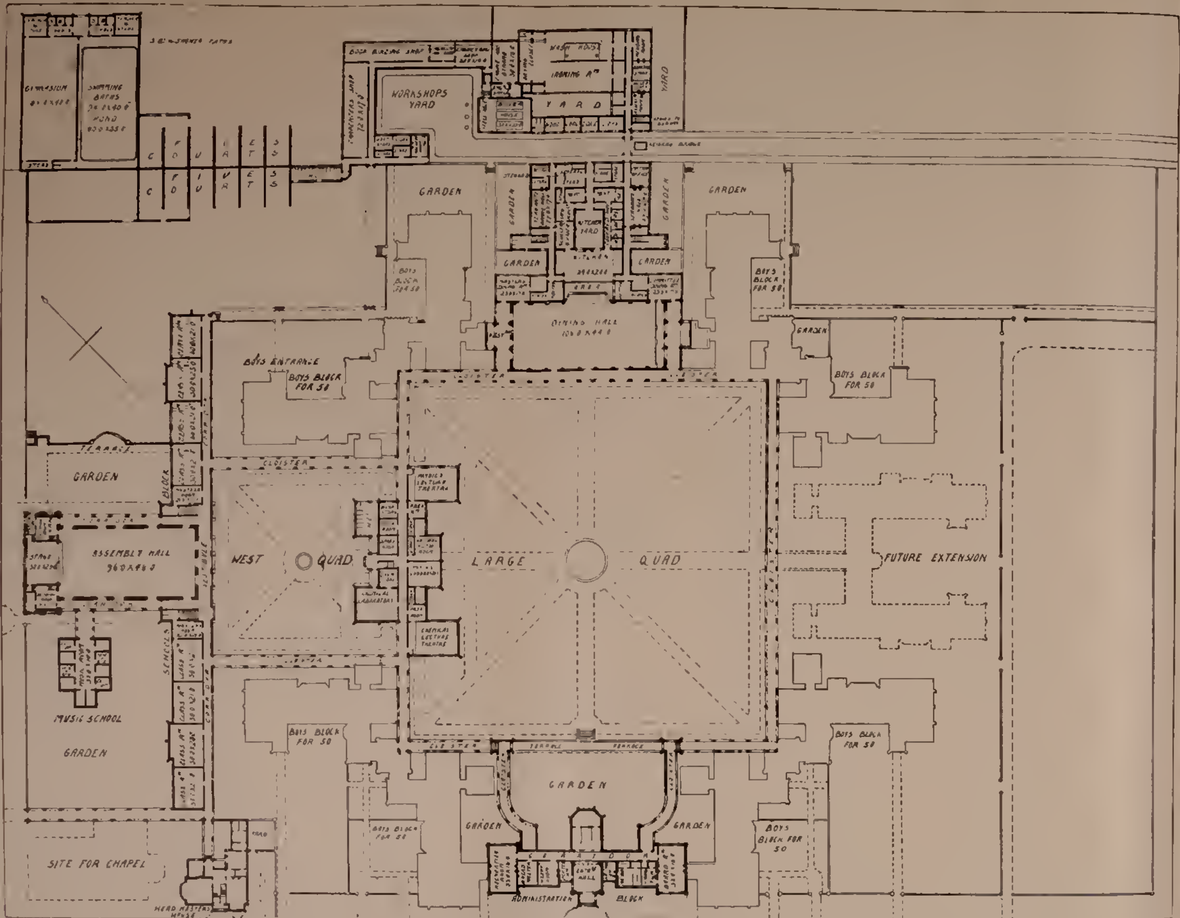
197. Competition Design for the Royal Masonic School, Bushey.

B. Champneys, Architect.



198. Block Plan of the Royal Masonic School, Bushey.

Gordon & Gunton, Architects.

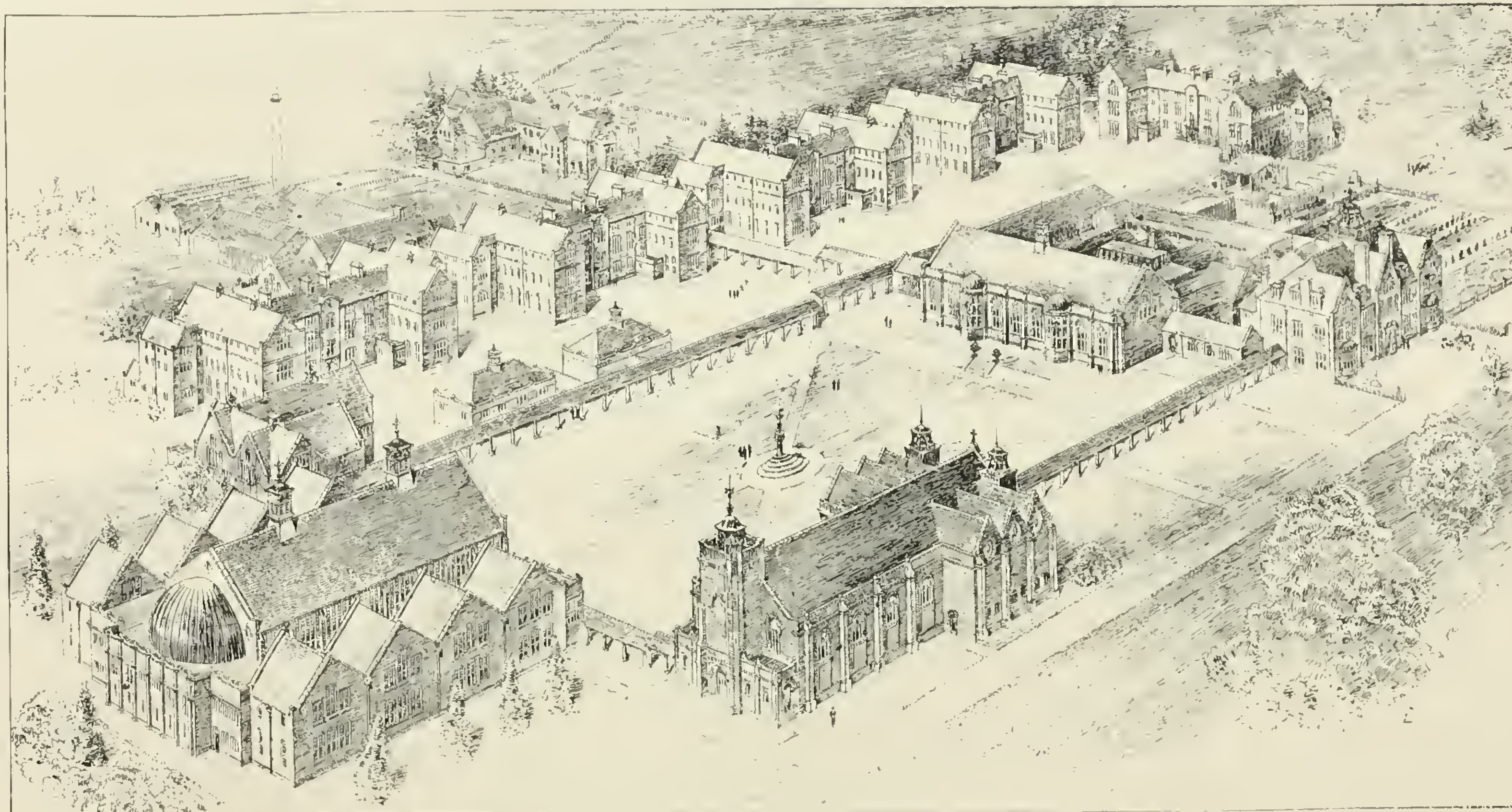


196. THE ROYAL MASONIC INSTITUTION FOR BOYS, BUSHEY. General Plan.

Gordon & Gunton, Architects.

199. The Royal Masonic Institution, Bushey.

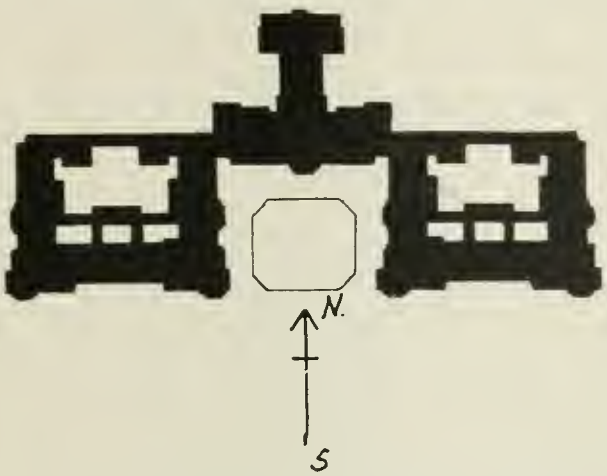
Gordon & Gunton, Architects.



200. Competition Design for the Royal Masonic School, Bushey.

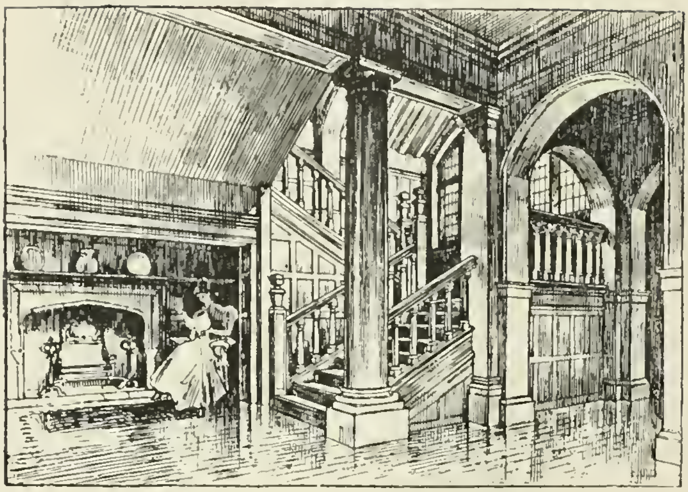
B. Champneys, Architect.

plans of this school, now in course of erection at Bushey. It offers a somewhat similar problem to the last on a rather smaller scale. The design illustrated in Fig. 198 was selected in a limited competition, and Messrs Gordon & Gunton were instructed to carry out the work. The winning design in this case is based on the system of quadrangles, of which there are two. Round the larger are ranged on the south-west the administrative block; the dining-hall, kitchen, and offices on the north-east; while at each corner is placed a double block of residential buildings. The science block is placed on the north-west side. Opposite to this a space has been left where another boarding-house can be erected should it be required at a future time. The smaller quadrangle leads to the assembly hall and class-rooms. The arrangement of the buildings can be clearly seen in the bird's-eye view shown in Fig. 199. The whole scheme is a good example of compact and ingenious planning, but it may be perhaps permissible to point out that from the point of view of health it suffers from disadvantages mentioned above, inseparable from a building planned symmetrically round a quadrangle. The placing of the boarding-houses at each angle of the square, as pointed out above, necessarily involves a wrong aspect for a certain number of them, while the compactness of the plan involves the use of a considerable number of small courts and confined areas.

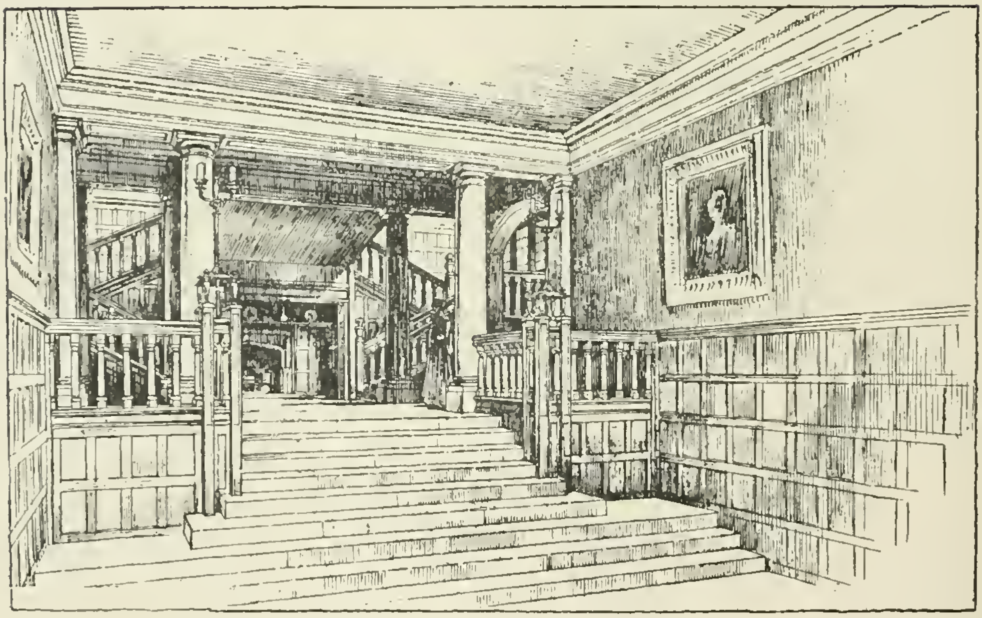


201. The Roedean School, Brighton. Block Plan.
J. W. Simpson, Architect.

For the purpose of comparison again there is illustrated in Fig. 197 the block plan of a competition design for the same school by Mr Champneys immediately above that of the school as carried out (Fig. 198). The idea of Mr Champneys' plan is well shown in the bird's-eye view in Fig. 200. In this case the school buildings form a block arranged round an oblong-shaped quadrangle, while the residential portion of the school is detached and arranged in five separate boarding-houses, somewhat on the lines of the buildings for Christ's Hospital at Horsham.

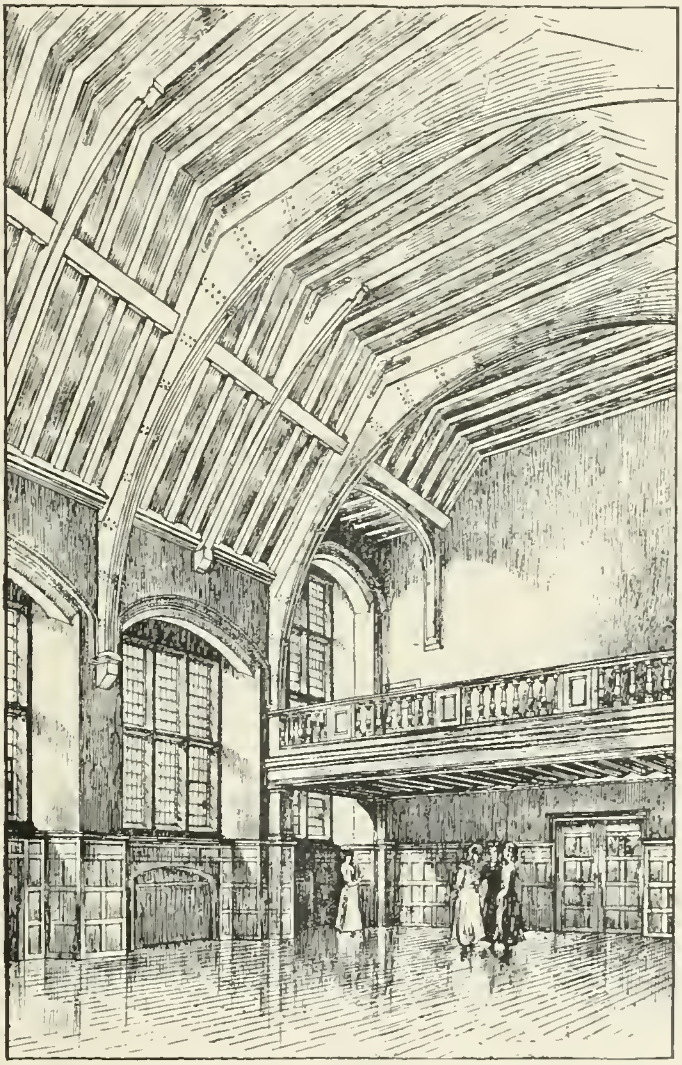


202. The Roedean School. Inner Hall.



203. The Roedean School. Main Entrance.

These two schools—one just completed, the other in course of erection—will give a good idea of the requirements and arrangements of a large Boarding School for boys. In one case the selected design is based on the quadrangular system; in the other, the larger, the open or divided plan. The latter plan, for reasons stated above, seems on

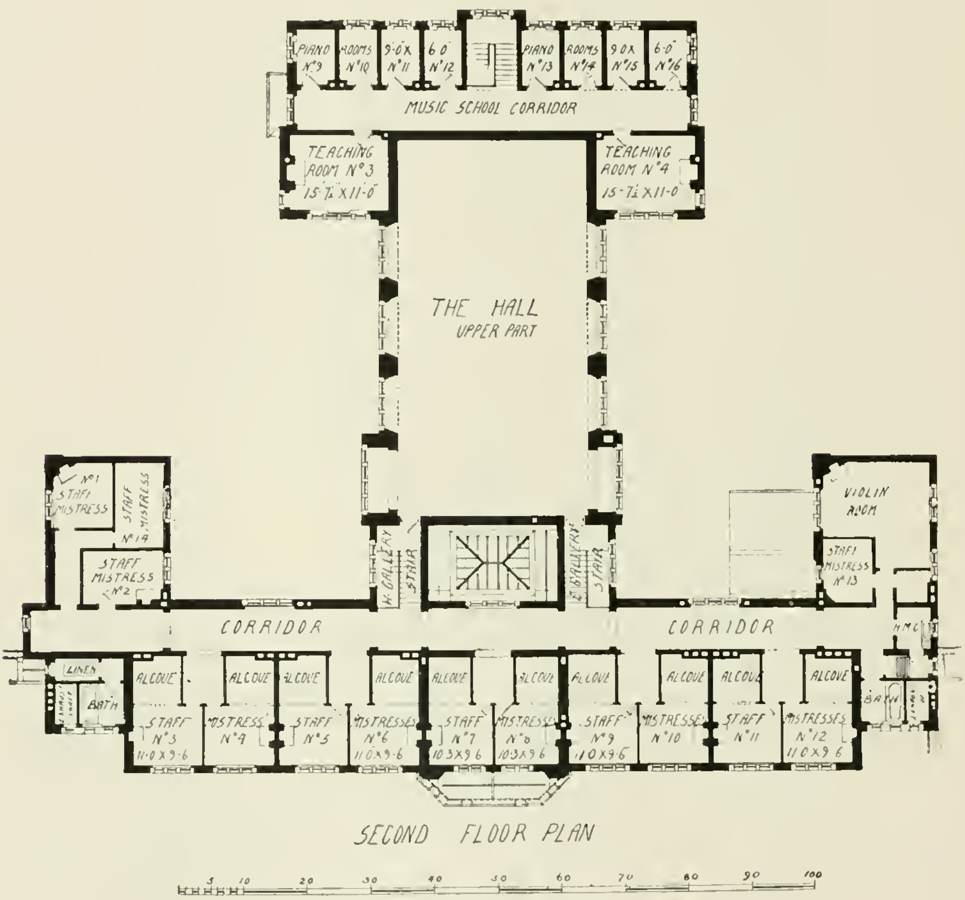


204. THE ROEDEAN SCHOOL. End of the Hall.

the whole the more satisfactory method for a school of any size, and will, if a prophecy be admissible, be probably the form upon which schools of the future will be planned.

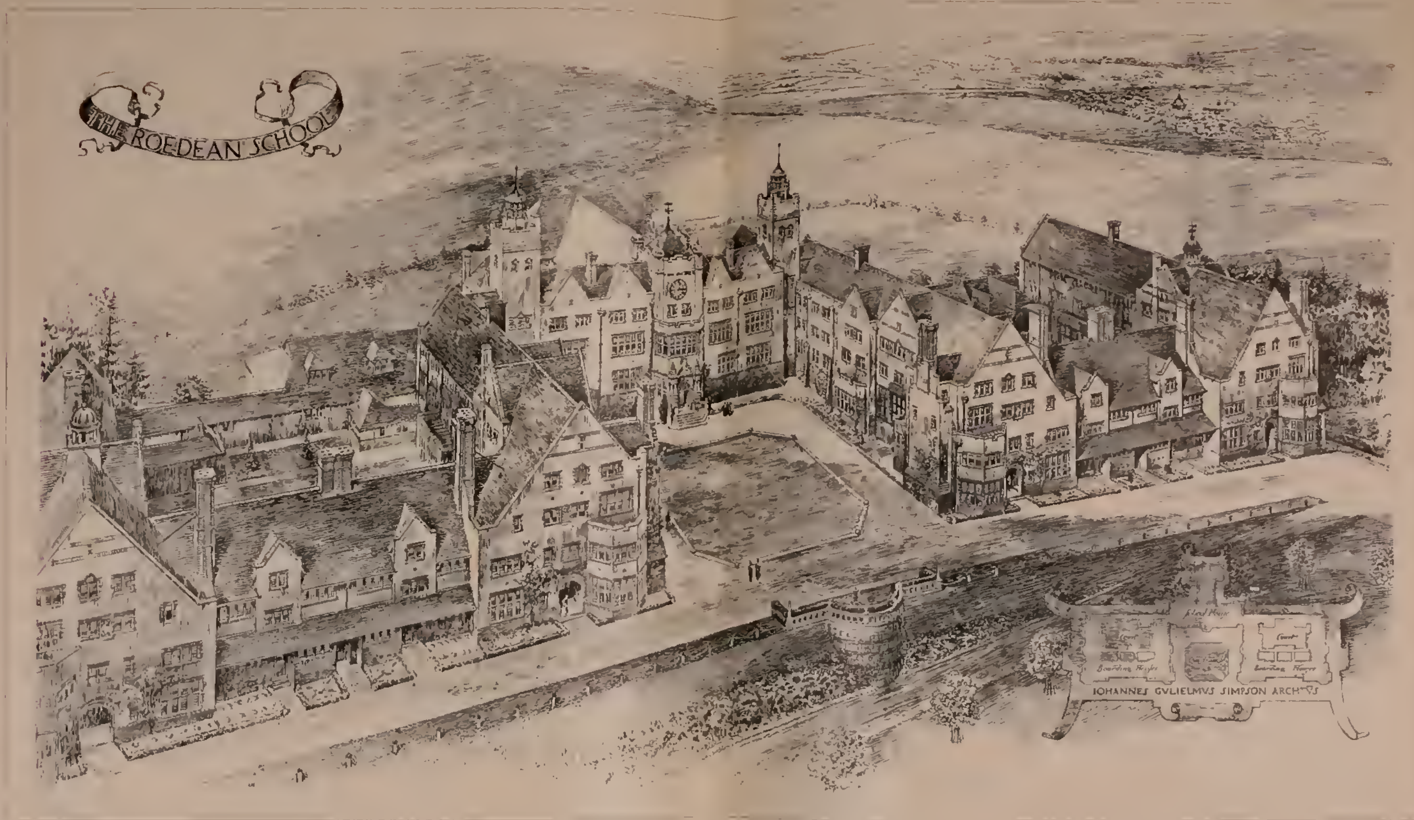
The Roedean School, Brighton.—This shows an example of a Girls' Boarding School to take 200 girls, arranged in four separate blocks of

houses, Fig. 201, all connected by one long corridor. The buildings (see bird's-eye view, Fig. 205) form an imposing front looking right over the sea to the south. The site itself is by no means an easy one on which to arrange a large block of buildings, as it slopes rather sharply. The block of school buildings, hall, class-rooms, &c., form the back of a quadrangle formed by the boarding-houses, but which is



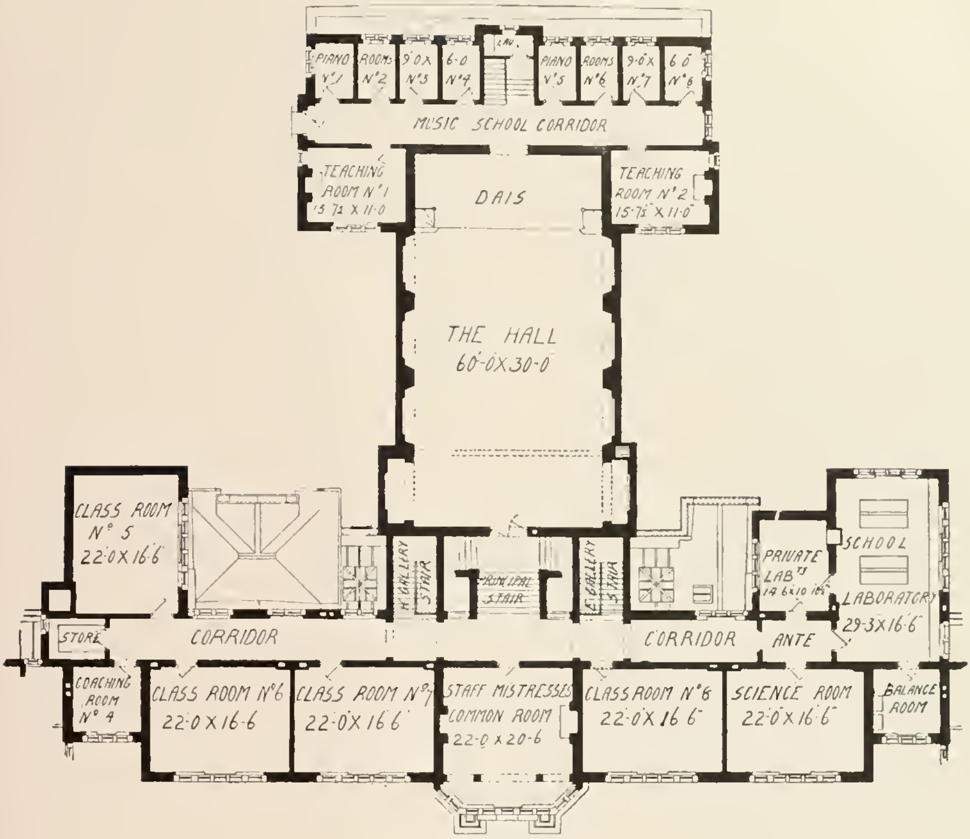
206. The Roedean School, Brighton. Central Block.

left open on the south side. This quadrangle, some 480 ft. wide, has a depth of 225 ft. The class-rooms, all measuring 22 ft. by 16 ft. 6 in., are placed on the ground and first floors, looking, with one exception, due south. Over them, on the second floor, are the rooms for the staff. These rooms look south, and are made, by means of an alcove, to serve as bed and sitting room (see Fig. 206). The main entrance in the centre of the building leads into a handsome vestibule, with a wide flight of

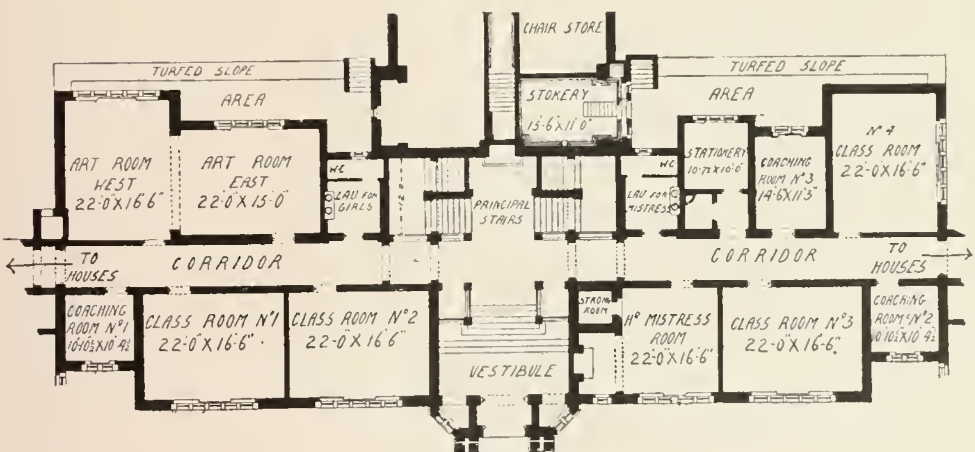


205. THE ROEDEAN SCHOOL, BRIGHTON.

J. W. Simpson, Architect.



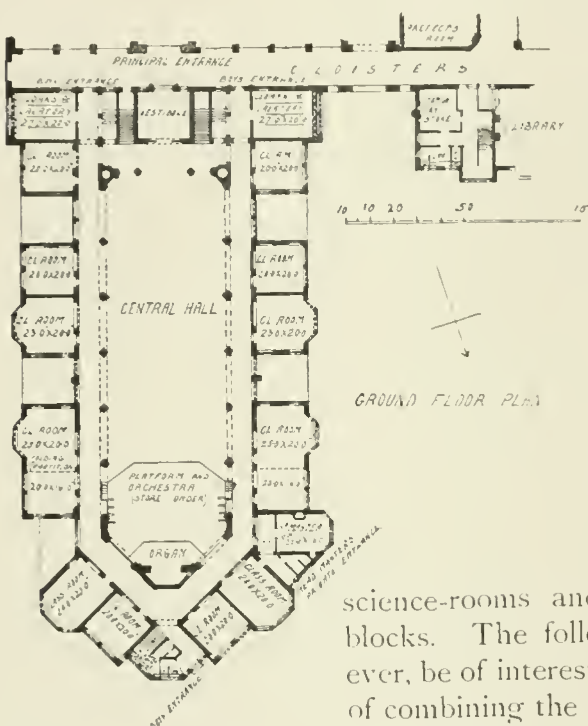
FIRST FLOOR PLAN



GROUND AND BASEMENT FLOORS

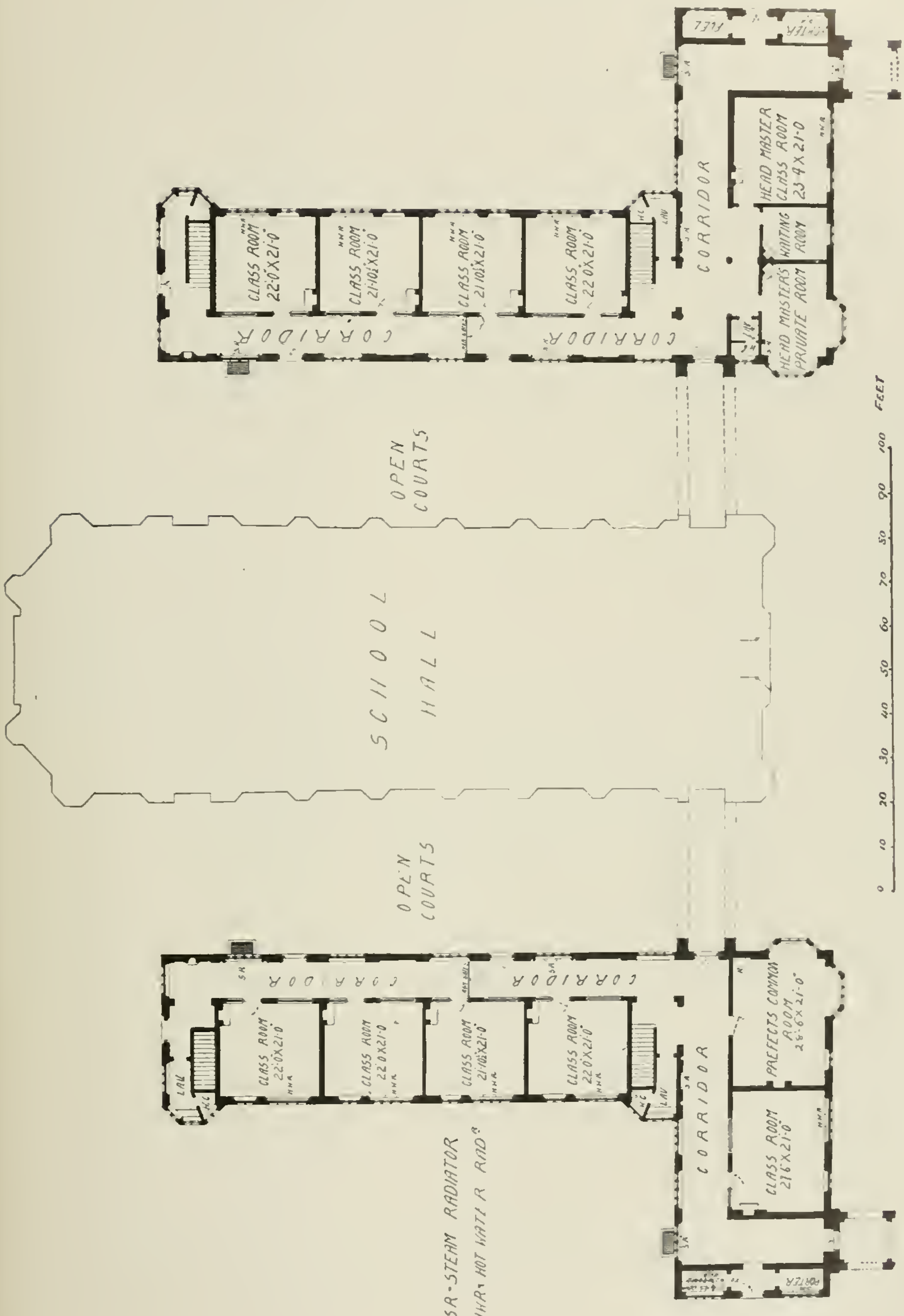
207, 208. THE ROEDEAN SCHOOL, BRIGHTON. Central Block.
J. W. Simpson, Architect.

stairs (see Fig. 203) leading to the corridor which runs from one end of the school to the other, with which the different houses are connected. A second short flight of stairs leads to the hall (see Fig. 202). The hall, panelled with wood, and with open timber ceiling, has a rich and pleasing effect. At the farther end of this is arranged the Music School, so that all noise is effectively cut off from the rest of the school. There are sixteen practising-rooms and four for teaching, a retiring-room being provided for the music professor. One of the boarding-houses is illustrated and described below. The building throughout has been treated artistically and decorated with great taste, the differences in levels offering opportunities for architectural effect, of which full advantage has been taken.



209. Competition Design for Christ's Hospital. Hall and Class-rooms. *Paley & Austin, Architects.*

As mentioned above, the educational requirements of a Boarding School do not materially differ from those of a Day School, except that the problem of arrangement is rather simplified by the lack of cloak-room requirements, and by the method usually adopted of putting the science-rooms and music-rooms in separate blocks. The following examples may, however, be of interest, as showing some methods of combining the school hall with the class-rooms, differing from those in the Day Schools figured above. In Fig. 210 are shown the class-rooms and hall as they are arranged at the new buildings for Christ's Hospital at Horsham. They are here arranged in two L-shaped buildings, the shorter arm being connected to the hall. The class-rooms themselves do not actually form part of the building, which of course prevents any possibility of supervision from the hall itself. The Headmaster's room is placed at the end of the corridor in one block, while the prefects' room occupies a similar position in the other. This arrangement will probably prevent any tendency to disorder in

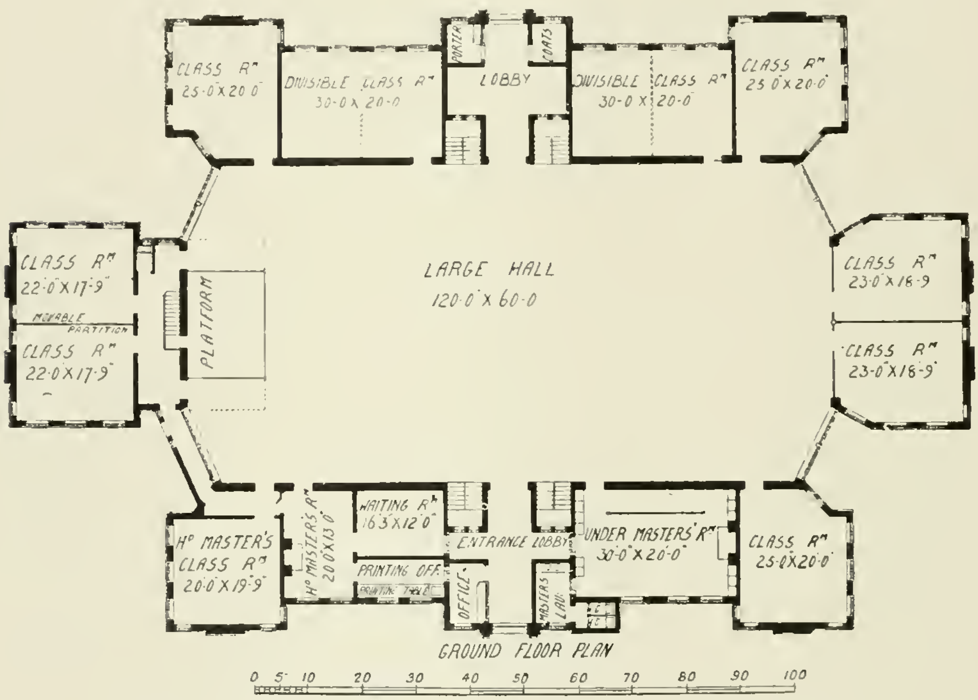


210. The New Buildings for Christ's Hospital, Horsham. The Hall and Class-rooms.

Sir Aston Webb & Mr Ingress Bell, Architects.

the corridor. This separation of the class-rooms from the main block will enable very free ventilation to be obtained. The hall runs north and south, so that the class-rooms face east and west.

Fig. 209 shows, from Messrs Paley & Austin's competition design for the same building, the hall and class-rooms. They are here grouped in pairs, presumably to allow of light being obtained in each case on two sides, while at the same time making it possible to get windows into the hall. It is difficult to altogether



211. Competition Design for Bedford Grammar School.

Hall and Class-rooms.

B. Champneys, Architect.

approve of this ingenious plan, as the windows in the end wall will have to be either in the eyes of the teachers or pupils, while the class-rooms are not of a sufficient size to require light from more than one side.

Fig. 211 shows another design, by Mr Basil Champneys, taken from a competition design for the Grammar School at Bedford. This is an attempt to place the class-rooms so that they shall open off the central hall, and yet still make it possible to have large windows into the hall.

KITCHENS AND OFFICES.

In large schools where the whole school take all their meals in the central hall, the kitchens have naturally to be on a large scale, and are differently arranged to those in a house where not more than 40 or 50 have to be catered for. The connection between the kitchen and the dining-hall is naturally of great importance in order to save waste of time. It is not easy to say exactly what rooms it is essential to supply, but it is hoped that the following list will mention at least those that are necessary.

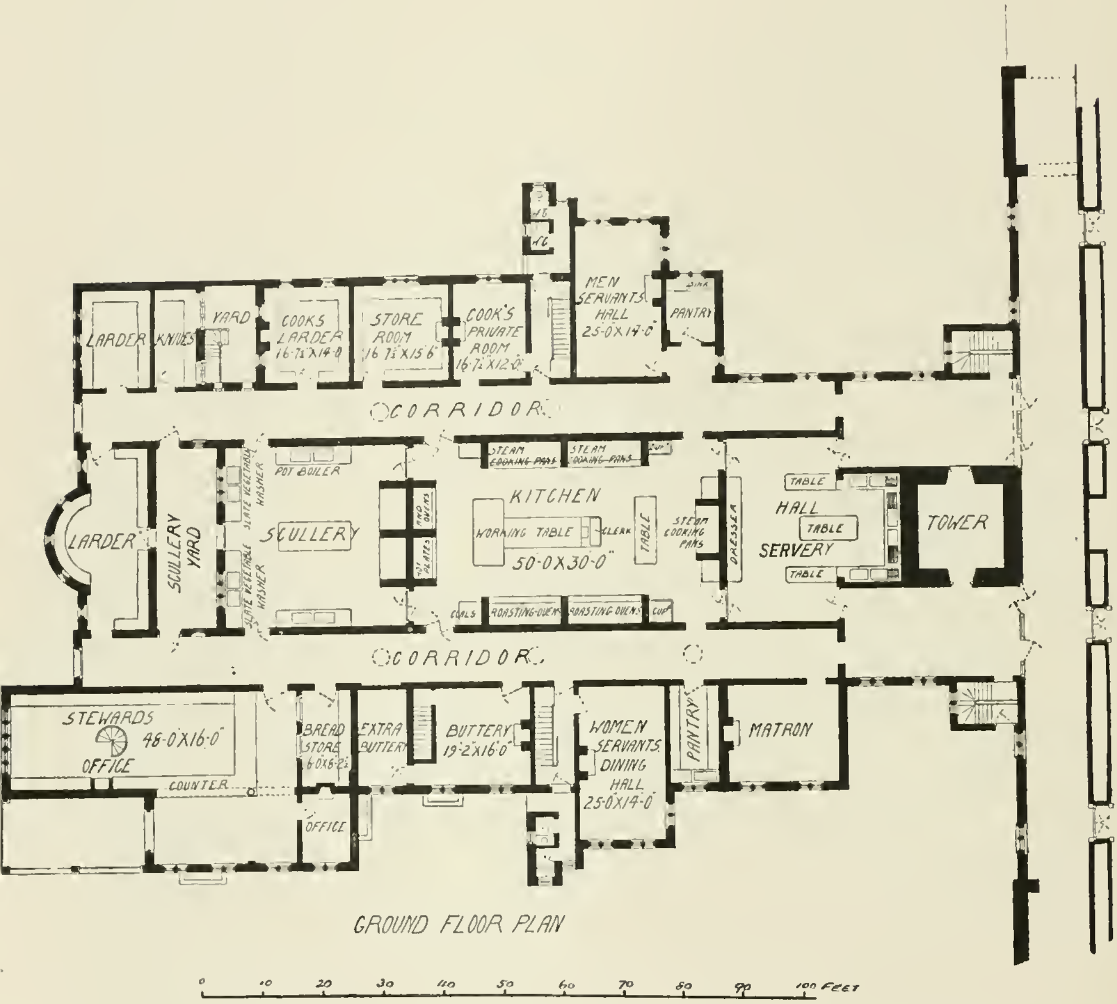
Kitchen.—The main kitchen should of course be of considerable size, well lit and ventilated. As it is usually fitted with steam cooking and roasting ovens round the greater part of the wall space, allowance for the loss of some 3 ft. all round should be made. For this reason top lighting is an advantage owing to the increase of wall space. The main kitchen at Christ's Hospital, where there are between 800 and 1,000 to be fed daily, measures 50 by 30 ft. That at the Masonic Institute, where about half that number have to be provided for, measures 34 by 22 ft.

Sculleries.—The scullery is often divided into two parts—a convenient plan, as the vegetable cooking as well as washing is done there.

Larders.—Separate larders are usually provided for cooked and uncooked meat, milk, bread, pastry, and vegetables, though of course these are sometimes combined; a cook's store-room and grocery store, china and glass store, coal and wood and knives; an office for the steward conveniently placed near the entrance, so that incoming stores can be checked easily; a weighing bridge so arranged that heavy goods can be easily wheeled upon it for weighing; a private sitting-room for the cook; a matron's room in connection with the stores for clean and soiled table linen; a separate dining-room for men servants and women servants, necessary conveniences, &c.; buttery and pantry; a large serving-room fitted with apparatus for keeping plates hot in close connection with the dining-hall.

In the kitchen arrangements for the new buildings at Horsham (see Fig. 212) simplicity and directness of access have been held chiefly in view. There is a large serving-room with a door at each end into the kitchen, and also two doors immediately opposite the down landing into the long corridor outside the dining-hall. It will be noticed that the doors from the corridor to the servery are arranged each side

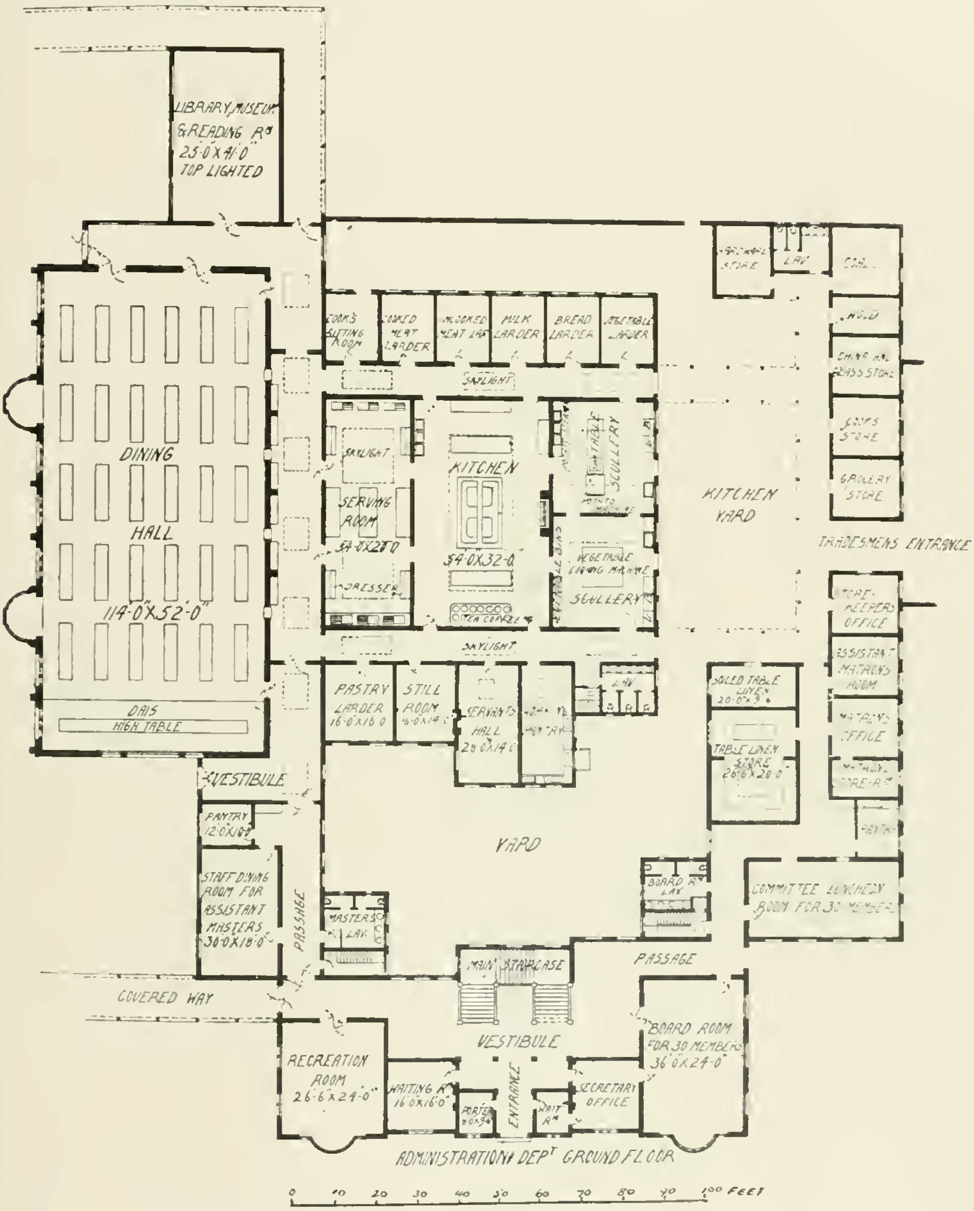
to allow of two streams passing in opposite directions. This arrangement is necessitated by the custom at the school of detailing a certain number of boys who come from the hall and fetch the dinner. This of course means large numbers continually passing each other. The



212. Kitchen Block, New Buildings for Christ's Hospital, Horsham.
Sir Aston Webb & Mr Ingress Bell, Architects.

plan (see Fig. 212) has been well arranged to provide for an easy circulation. A wide corridor is arranged outside the hall, from which there are four double doors into the hall. To correspond with these there are four doors into the servery department. Two straight corridors run down each side of the kitchen and sculleries, off which

all the rooms open. By means of this a line of boys can come out of the hall, file through either the hall servery, kitchen, or scullery, and into the hall again by the opposite door, or *vice versa*.



213. Kitchen Block.

B. Champneys, Architect.

Fig. 213 shows a convenient and compact arrangement of dining-hall and kitchen, which provides a larger number of rooms but of

smaller size. It is intended to provide for about 500. This shows the administrative block as well. A large number of the offices are in this example situated in an annexe, but connected by a covered way.

The kitchens and dining-hall of the Royal Masonic Institution can be seen in Fig. 196. This again is intended to provide for some 500. The kitchen is placed in the centre, and the other rooms and offices grouped round it. In the plans of St Paul's, West Kensington (see Fig. 119), is shown a neat and compact form of kitchens, &c., arranged on the top floor, and intended to supply one meal daily for about 200.

Chapter X.

BOARDING-HOUSES.

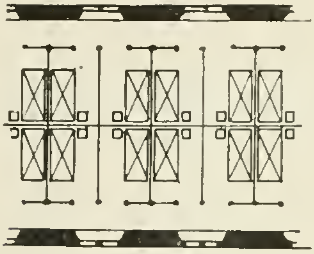
Dormitories or Cubicles, Arguments in favour of each—Cubicles, Size required and Arrangement of—Various Modifications between Cubicles and Open Dormitories—Area of Floor Space required for Sleeping-rooms—Examples of some recent Buildings—Distance between Beds—Washing Arrangements—**Day-rooms**, Size, Position, and Aspect—Furniture for—Monitors—Day-rooms in German Schools, Examples—**Changing-rooms**, Size and Arrangement—Other Rooms required in Boarding-houses—Illustrations and Descriptions of School Boarding-houses—New Buildings for Christ's Hospital, Horsham—Messrs Paley & Austin's Competition Plans—Royal Masonic Institution, Bushey, a Competition Design—Boarding-house for Cheltenham Ladies' College—Roedean School, Brighton—Colet House School.

The most important question in relation to boarding arrangements is that referring to the dormitories and sleeping arrangements.

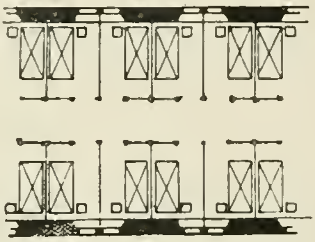
Dormitories and Cubicles.—It does not come within the province of a book of this sort to discuss the merits of the cubicle system as opposed to that of the open dormitory or that of large rooms with eight or ten beds; the question is very fully discussed by Dr Clement Dukes in his book "Health at School," and it will be sufficient to say here that the opinion both of Headmasters and of school doctors is very strongly in favour of the open room or small dormitory on all grounds. In vol. vi. of the "Special Reports" of the Board of Education are given the answers of the Headmasters of a number of Private Schools to certain questions on school management, and of 108 who replied in reference to cubicles and dormitories 93 were in favour of the open rooms. It is not improbable that cubicles have come into use chiefly in deference to the wishes of parents, to whom the privacy thereby obtainable for the boys seems to offer many attractions. The system of having a small room for each boy, or one for two boys, which serves as sleeping, feeding, living, and working rooms, and which measures about 8 or 9 ft. square, though in use in some of our older schools, is one very unlikely to be repeated in a new building. The

necessity of shutting the bed up in a kind of box arrangement as soon as the occupant is up prevents any proper airing of the clothes, and is in every way objectionable.

A common arrangement is to put the younger boys in dormitories, providing cubicles for some of the older pupils.



214. Cubicles with Double Corridor.



215. Cubicles with Central Corridor.

Cubicles.—In providing cubicles, the usual plan is to have a long narrow room with windows down both sides, arranged with a passage down the centre, formed by the partitions of the cubicles, and into which they all open. These partitions are usually of wood, and are not as a rule carried up to the ceiling, but arranged to leave an

216. Interior View of a Dormitory, St Margaret's School, Bushey, showing Recesses at Head of Beds.

open space of 4 or 5 ft. above for the purpose of ventilation, the upper part of the partition being often provided with some sort of apparatus of wire or woodwork, to prevent any too adventurous spirits climbing about on the top. The size of a single cubicle varies from 6 ft. 6 in.

by 9 ft. to 9 or 10 ft. square. In German Boarding Schools when the cubicle system* is found, much the same measurements prevail. Figs. 214 and 215 show two methods of arranging the lines of cubicles and the corridors, the central corridor (Fig. 215) being obviously the more economical in space. There is practically no difference in the amount of actual floor area required for dormitories, whether cubicles are used or not, the same number of square feet of floor space per head having to be provided in either case. As regards the window, the plan usually adopted is to divide a window between two cubicles, as in Fig. 215. Various combinations have been tried in order to combine a certain amount of privacy with the advantages of an open dormitory. For example, as shown in Fig. 216, taken from the Clergy Orphan School at Bushey, a small partitioned-off place for washing, &c., is provided at the head of the bed. This is not an uncommon plan, and one which has been found satisfactory (see for plan of such rooms, Figs. 242 and 250).

Two beds placed side by side, with a partition between of sufficient height and length to make a complete division, enable a considerable gain in distance between the beds to be gained.

Area required.—Whether open dormitories or dormitories partitioned off into cubicles be used, there should be an allowance of not less than 65 sq. ft. of floor space per head. It may be of interest to give the figures of a few dormitories in recently erected buildings :—

Regulations of the Board of Education - -	65 sq. ft.
Leys School, Cambridge - - - - -	62 ,,
Royal Masonic Institution for Boys, Bushey -	$56\frac{3}{4}$,,
Clergy Orphan School, Bushey - - - -	66 ,,
New Buildings, Christ's Hospital - - -	72 ,,
Messrs Paley & Austin's design for New Buildings, Christ's Hospital - - - - -	68 ,,
Dr Clement Dukes' model dormitory - -	72 ,,

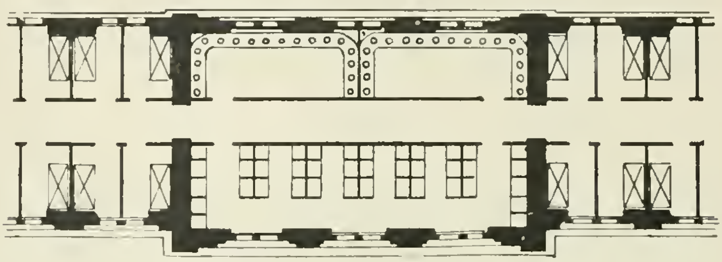
The distance between the beds is usually from 2 ft. 3 in. to 2 ft. 6 in., the bed itself being 6 by 3 ft., and if possible not less than 5 ft. should be provided between the foot of one bed and that of the bed opposite ; but of course the more space that can be provided the better. Dr Clement Dukes † gives what he considers a model dormitory. The beds are 3 ft. 6 in. apart, with a passage down the centre of the room 11 ft. 6 in. wide in which are placed the basins. The room takes twelve beds, and, measuring 36 by 24 ft.,

* This is usually only in Training Colleges, and even then chiefly for women students.

† "Health at School."

allows 72 sq. ft. per head, an amount which is certainly very desirable. In large dormitories it is usual to find at one or both ends a fair-sized cubicle, which is occupied by a monitor or prefect, who is placed there to keep order in the room. This room should have a window or opening giving a good view of the dormitory (see Fig. 221). In close connection with each dormitory or room, but cut off by a cross-ventilated lobby, should be placed one or two water-closets, for night use only. The most convenient plan probably is to have a small spur building in which they can be arranged one over the other for each floor (see Fig. 221). The closet for soiled linen can be well placed in this as well, and it should also be provided with two or three wash-hand basins.

The ordinary washing arrangements are placed either in the dormitory itself or in each cubicle, or else, as is without doubt the most satisfactory plan, in a special lavatory close by. There should of course



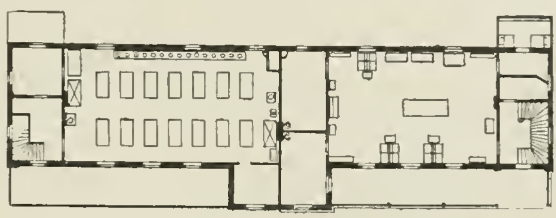
217. Cubicles, Lavatories, and Locker-Room, from a German School.

be a basin for every boy, and a separate peg or shelf for towels, sponges, &c. Fig. 217* shows an example of a German School with cubicles in which all the basins are placed in a central position, the boys' lockers being arranged immediately opposite. For details of lavatory fittings, &c., see chapter on sanitation.

Day-Rooms.—The day or living room should be a large well-lit room. Its shape is usually long and narrow, due to the fact that it is commonly placed under, and follows the same lines as the dormitory above. This room being the place where the boarders spend nearly all their out-of-school time, should be comfortable and roomy, placed so as to get plenty of sun. In calculating the area, not less than 20 to 25 sq. ft. per head should be allowed, but of course the larger and

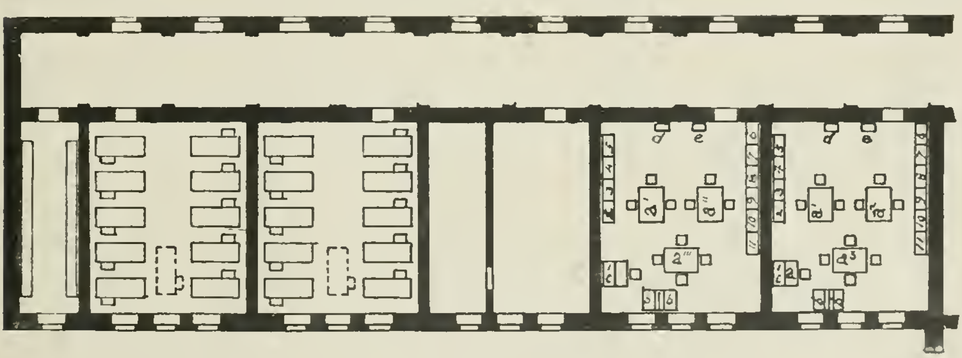
* Handbuch der Architektur.

brighter the room the better,* and it is not unusual to find as much as 60 sq. ft. The furniture may consist of tables and benches, or of box desks of which each pupil has one. In the former case a locker has to be supplied for each boy. These are sometimes arranged round the walls of the day-room, but the more satisfactory arrangement is to have a special locker-room. Where there is no dining-room, and the living-room has to serve for meals as well, it is naturally fitted with tables and benches. The plan of fixing them firmly to the floor will save a good many accidents, but it is essential that plenty of space for moving about be provided.



218. Sleeping and Living Room.

In many cases a separate and smaller living-room is provided for the monitors or older boys in the house. In addition to these rooms there are often provided a number of little rooms, generally called studies, measuring about 6 or 8 ft. square. In some schools there is one provided for every boy, but perhaps more usually there are a certain number for the older boys. In German Boarding Schools there are, as a rule, day-rooms or living-rooms exactly corre-



219. Two Dormitories and Day-Rooms, with Masters' Room in the Centre, from the Joachimsthal'schen Gymnasium, Berlin.

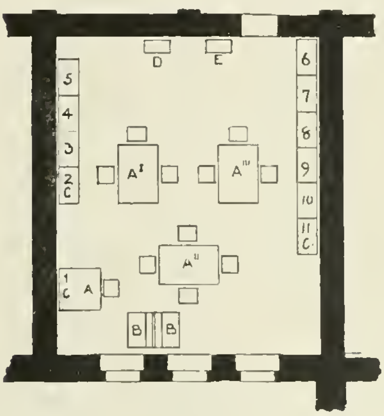
sponding to the sleeping-rooms, and generally arranged close together (see Fig. 218). These living-rooms are mapped out with an almost military precision. Not only is the position of each boy marked out and shown on the plans according to the form he is in, but the exact place of everything is shown, down to the waste-paper basket.

* In the new buildings at Christ's Hospital about 40 sq. ft. is given.

Fig. 219, taken from the *Handbuch der Architektur*, shows two sleeping-rooms to take 10 or 11 boys, and their corresponding living-rooms. Fig. 220 shows one of the living-rooms in more detail. Each boy, as mentioned above, has his allotted seat, and that marked "A" is a special desk for the head boy of the room, who is supposed to be responsible for the discipline. A special desk is often provided near the window for any boy who is short-sighted. Comfortable chairs are sometimes provided.

But Boarding Schools in Germany are not found to any large extent, and cannot be in any way compared to the position held by Boarding Schools in this country.*

Changing-Rooms.—In order to obviate the necessity of boys going into the dormitories or bedrooms during the daytime, dirtying the floors, &c., with their out-of-door boots, it is necessary to supply a room or rooms for the purpose of changing into flannels. These rooms are preferably placed on the ground floor, and in close connection with the lavatories and latrines. Foot-baths in the proportion of one, say, to 15 or 20 boys are a useful addition, as are also shower-baths. Plenty of room is necessary, as it usually happens that all the boys are changing at the same time. Every boy of course has to have his place with a double peg for clothes, and a pigeon-hole underneath for football boots, tennis shoes, &c. This room requires careful heating and ventilation. It is as well that there should be in addition a drying-room for wet clothes. It should not be forgotten, in dealing with this room, that the money and other valuables which are often left in the clothes while the owners are out playing offer strong temptations with easy opportunities, and that, however high the standard of the school, there are sure to be from time to time boys who will avail themselves of them. Making the room visible from several points either by glass partitions or otherwise will generally prevent anything of the kind.†



220. Living-Room, from Fig. 219.

A. Head Boy's Place. A', A'', A'''. First, Second, and Third Table. B. Desk near window for short-sighted boy. C. 1-11. Lockers for each boy. D. Basket for Paper. E. Waste Basket.

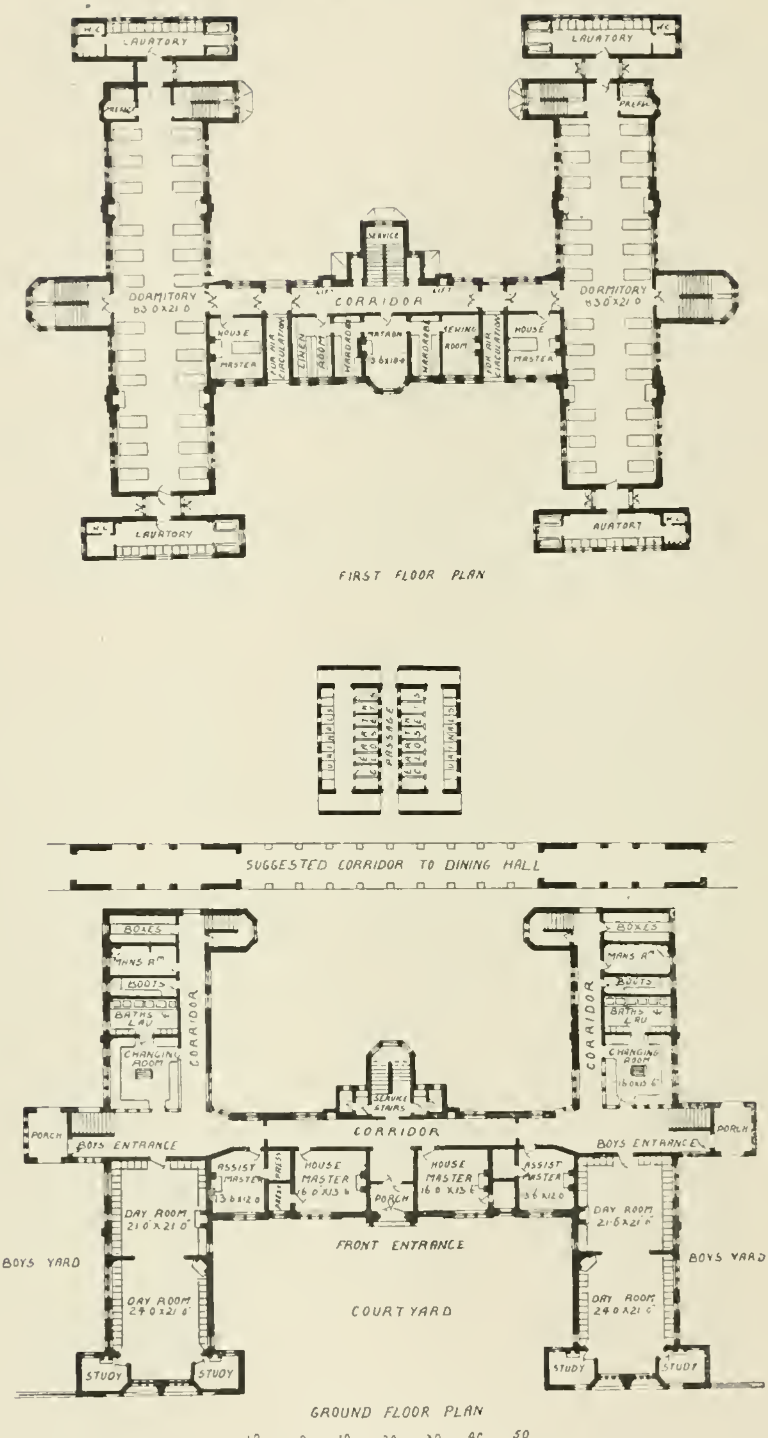
* For an interesting account of German Boarding Schools, see "German Higher Schools," by J. E. Russell, pp. 196-212.

† See pages 129, 130.

As regards size, there should, as mentioned above, be allowed as much as can conveniently be given, but if possible not less than 5 or 6 sq. ft. per head.

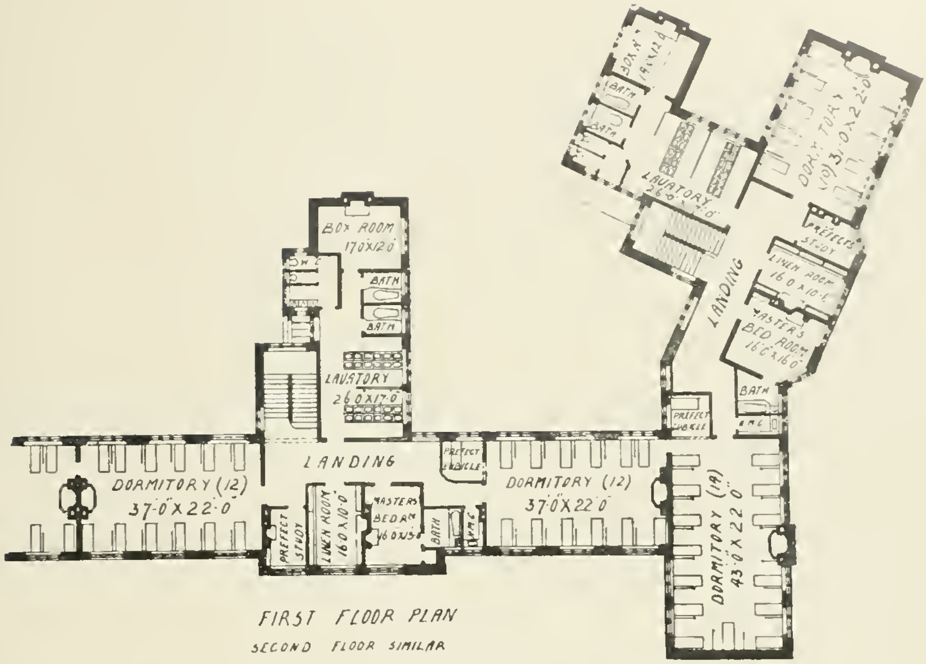
Other Rooms.—There are of course a certain number of other rooms found in a boarding house, according to the general arrangement of the school, such as the matron's room and linen store-rooms; a sick-room or quiet room for boys with minor ailments not requiring treatment at the school infirmary or sanatorium; rooms for the house master—these sometimes take the form of a complete house of the ordinary kind attached to the boarding house; sometimes a bedroom and sitting-room are supplied for an assistant master as well. The offices, kitchens, &c., naturally depend on the question of whether the boys get their meals in their boarding houses, or whether they have them together in the central block. The various plans given will give an idea of the different arrangements and modifications of rooms supplied, &c.

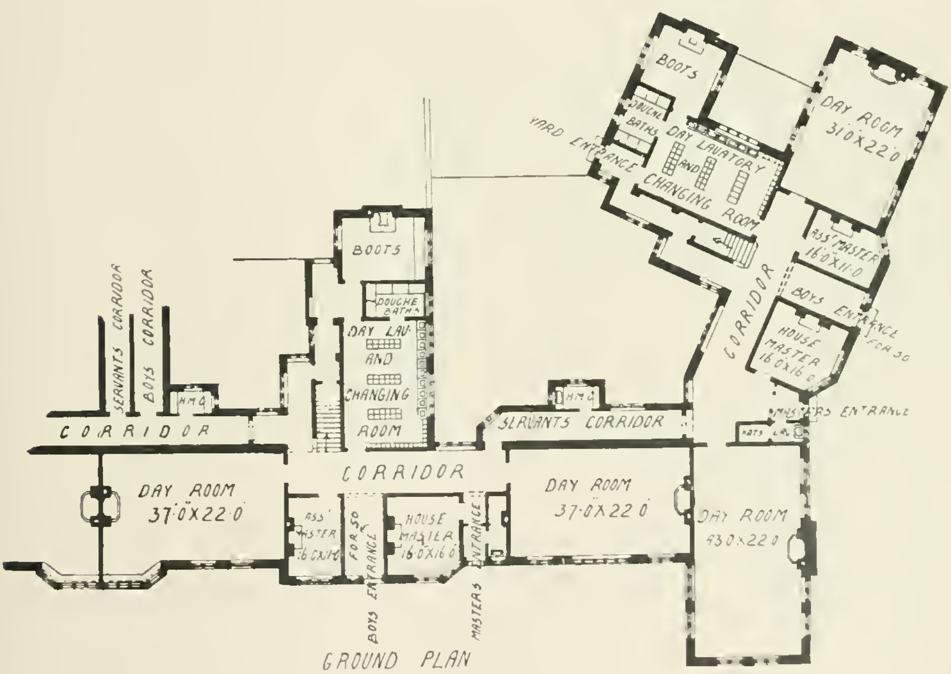
Examples of Boarding-Houses.—Figs. 221 and 222 show the plans of one of the boarding houses for the new buildings for Christ's Hospital at Horsham. These houses are arranged in two halves, the same in all respects, accommodating 50 boys each side in two dormitories. In the centre of the building are placed the house master's and matron's rooms; these are common to the two halves of the house, with ready access to either, but effectually separating the boys' part of the building. Each dormitory takes 24 boys, with a small room at the end for the prefect who has control of the room. At either end of the dormitory, cut off by an intercepting lobby, are the lavatories, each with accommodation for 12 boys, provided with twelve basins, two baths, four urinals, and a W.C. for night use. This arrangement is exactly repeated on two floors. The rooms are warmed and carefully ventilated, and have two staircases. On the ground floor there is the day or living room (a large cheerful room measuring 45 by 21 ft.), and divided into two parts by an open arch. The boys' lockers are arranged round the walls, two studies being provided at one end for the prefects or monitors. To the north of the passage, but with windows facing east or west according to the half of the house, are placed the changing-room, day lavatory, boot-room, box-room, and a room for the caretaker. All the rooms are decorated with a light green paint, and have a most cheerful and attractive appearance. In order to provide against any chance of stagnation in the air enclosed by the projecting wings of the



221, 222. ONE OF THE BOARDING-HOUSES, NEW BUILDINGS, CHRIST'S HOSPITAL, HORSHAM.

Sir Aston Webb & Mr Ingress Bell, Architects.





223, 224. A Boarding-House. Competition Design for Christ's Hospital.

Paley & Austin, Architects.

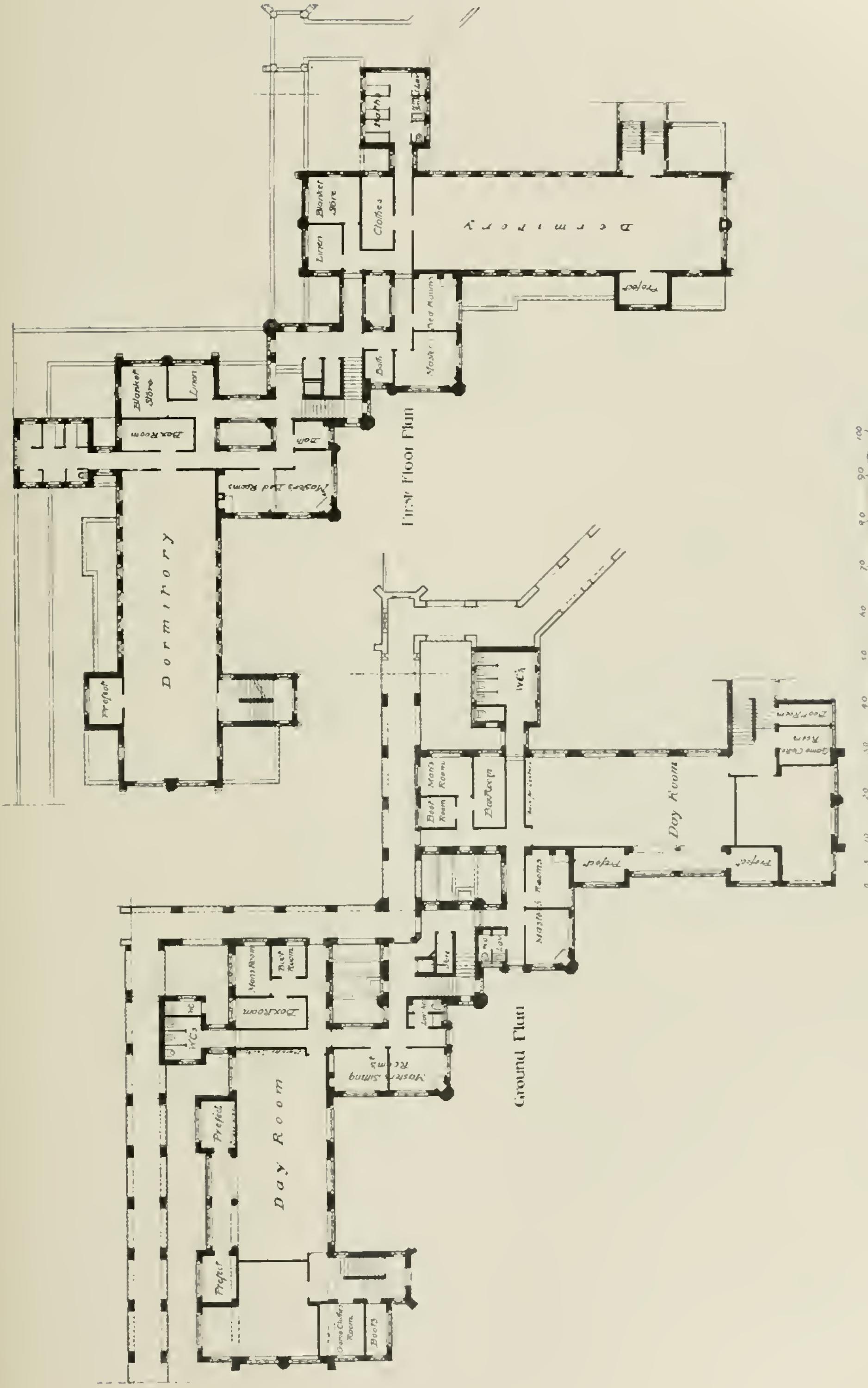
buildings, two large openings have been made right through the centre of the houses, the necessary space being gained by taking off from the height of the passage inside. These boarding-houses should be inspected carefully, as an excellent example of compact and economical planning, in which every inch of space has been taken full advantage of. The convenience and safety of the sanitary arrangements, and the degree of comfort attained, while keeping the building to the simplest possible plan, are especially worthy of notice.

In Figs. 223 and 224 are given the plans for a boarding-house as suggested by Messrs Paley & Austin in their competition design for the Christ's Hospital building. In this arrangement the dormitories are divided, each taking from ten to fourteen beds, giving 68 sq. ft. per bed, there being a prefect's cubicle provided in the two larger rooms. Each bed has a partition 4 ft. high, running from the head of the bed rather more than half-way down. The lavatories, &c., are arranged in two blocks, each accessible from two dormitories, with a basin to every boy. The day-room is again divided to correspond to the dormitories, and provides more room for each boy than in the preceding example, the changing-room again being of considerable size—the plan on the whole being much less concentrated and less compact than that illustrated above, and also providing a larger area per head in all the rooms except the dormitories, where it is slightly less. These houses would no doubt be rather more expensive to build than the preceding, but would make comfortable and convenient residences.

Royal Masonic Institution, Bushey.—Figs. 225 and 226 show one of the corner blocks of this school. For the general arrangement, see Fig. 196. Each of these blocks contains accommodation for 100 boys, arranged in two divisions of 50. Rooms for two masters are placed in each division. On the ground floor is placed the day-room with two prefects' studies opening into it. A changing-room, boot-room, and man's room are also provided. The necessary lockers are arranged on the end walls of the day-rooms. Over this are placed the dormitories, with linen, clothes, and blanket store. Three baths and small lavatory are placed in an annexe close to each dormitory.

In Figs. 227-229 is shown a suggested design for a boarding-house forming part of a design by Mr Champneys.* This shows a very compactly arranged house. On the ground floor the day-room is divided into two equal halves, with a prefect's study opening off each. The lavatory is placed on the ground floor in connection with the

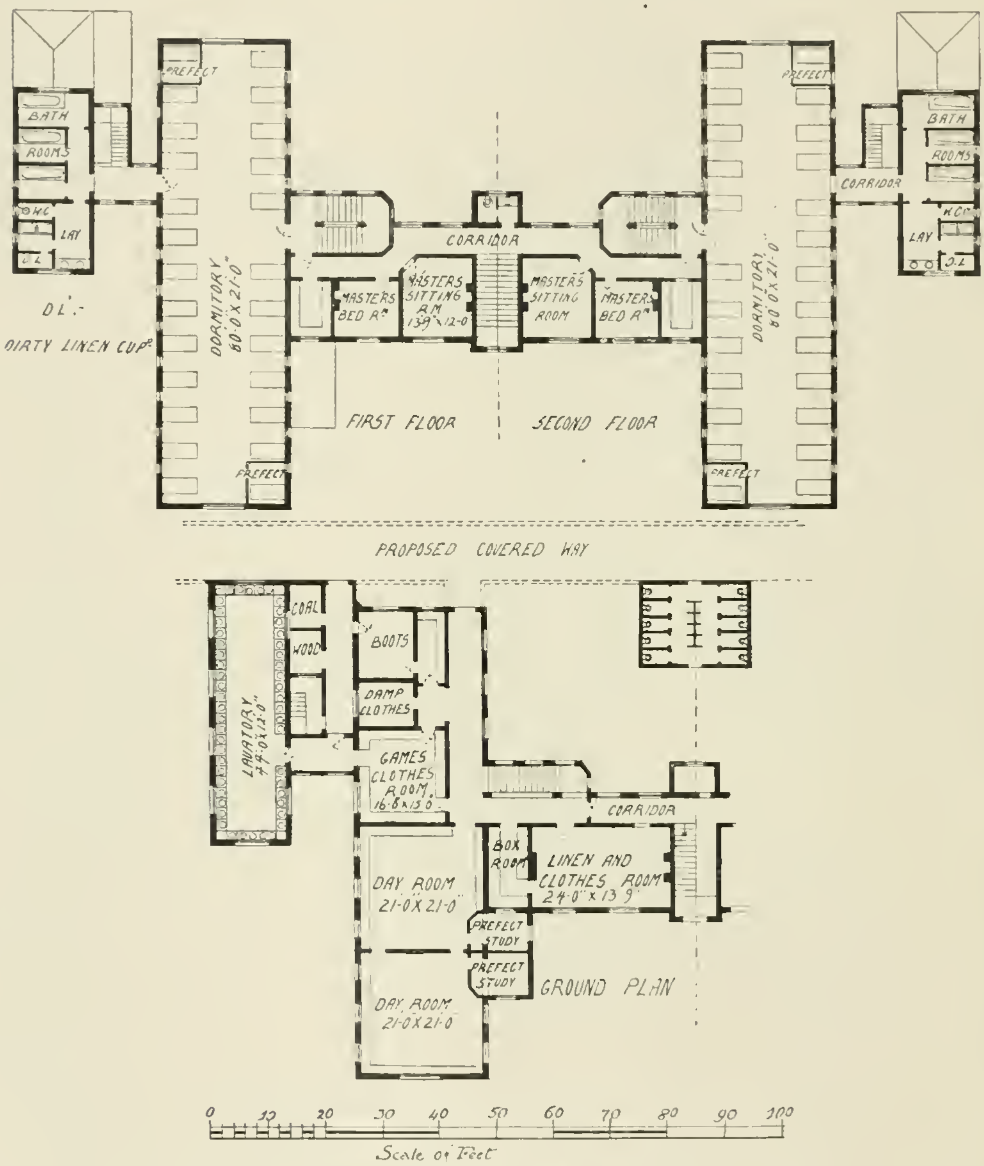
* Competition design for the Bushey School.



225, 226. THE ROYAL MASONIC INSTITUTION FOR BOYS, BUSHEY. One of the Corner Blocks of Boarding-Houses.

Gordon & Gunton, Architects.

changing-room. Each dormitory has an annexe for sanitary arrangements, cut off by an intercepting lobby, providing three baths for each 25 boys.



227-229. A Boarding-House, from a Competition Design.

B. Champneys, Architect.

Boarding-Houses for Girls.—In boarding-houses for girls there is generally a much higher degree of comfort provided. The boarding-houses attached to Cheltenham Ladies' College are

practically large dwelling-houses, arranged, as it were, with accommodation for an unusually large family. A large well-furnished drawing-room is used as the general sitting-room after the work of the day is over. In the most recent of these houses, erected at the end of last year (1901), there is accommodation for 40 girls. On the ground floor is the dining-room and a large work or preparation room, in connection with which are two smaller rooms which can, if required, be thrown into the larger. On this floor is also a large drawing-room, well furnished as in an ordinary house, where all the inmates collect during the evening. In the basement is arranged a play-room ; next to this is the boot-room, with an ingenious arrangement for boots. The man's boot-cleaning room is placed next door, the dividing wall being formed of pigeon-holes enclosed on either side by cupboard doors, so that by opening one side or the other the pigeon-holes are accessible from either room. The girls put their boots into their pigeon-holes, the doors are shut, and the boots are then cleaned and put back from the other side. The sleeping arrangements take the form of large rooms, each divided into four cubicles by wooden partitions, or in some cases by curtains. These cubicles are of considerable size, measuring some 10 or 12 ft. square, and are arranged so that each one has a window. Baths are placed in convenient positions, in the proportion of one to every five girls. On the top floor is placed a sick-ward, which can by means of an. intercepting lobby be completely isolated from the house.

In Figs. 230-232 is shown one of the boarding-houses of the Roedean School for Girls, Brighton.* The houses are connected with the main corridor by a passage, on either side of which are placed, close to the entrance, the lavatories, cloak-rooms, and offices. Along this passage are also arranged four studies for elder girls and their sitting-room, and on the side opposite to this the work or preparation room. The dining-room acts as a division between the girls' half of the building and the mistresses' and administrative blocks. On the second and third floors are the bedrooms, each girl having a small room to herself. The direction of the building being north and south, it has been possible to arrange that all these rooms face east and west, so that in every case they get the sun during some part of the day. There is a liberal provision of baths, five being placed at the end of a row of fifteen rooms. The plans are somewhat difficult to follow owing to the difference of levels, necessitated by the rapid slope of the ground.

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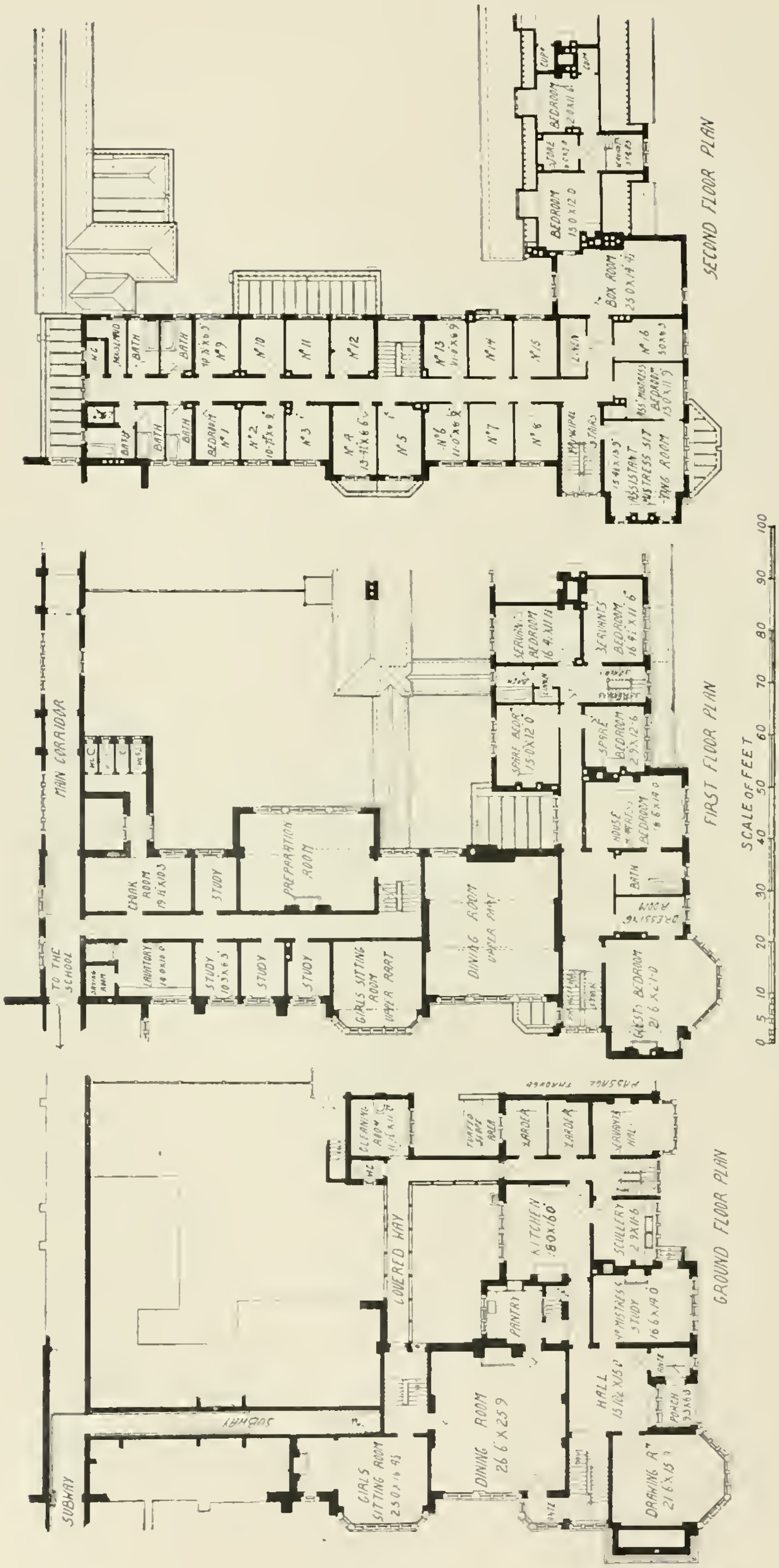
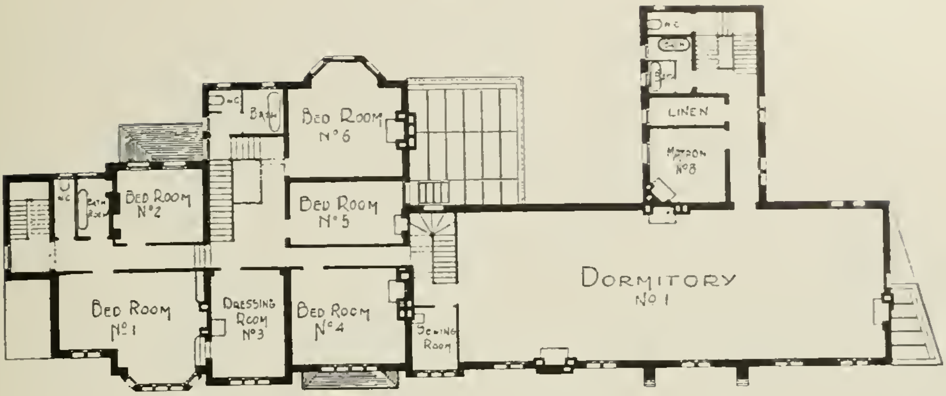
* For plans and description of rest of school, see page 213.

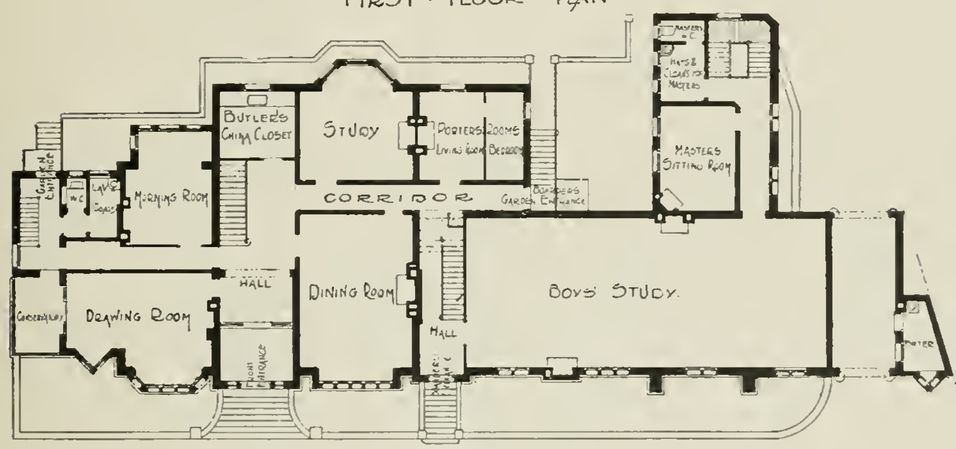


230-232. The Roedean School, Brighton. A Boarding-House.

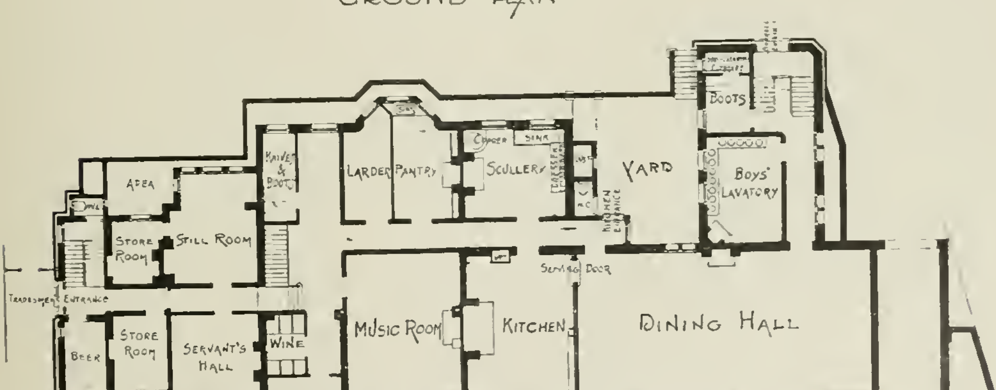
J. W. Simpson, Architect.



First · Floor Plan



Ground Plan



Basement Plan

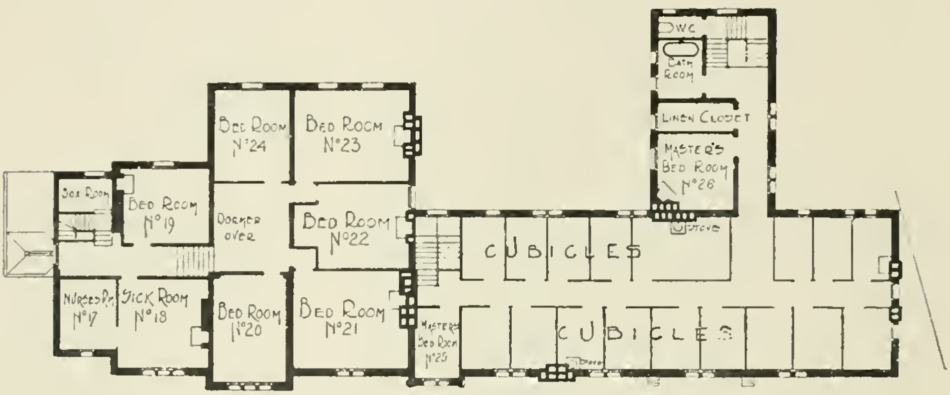
10 5 0 10 20 30 40 50

SCALE OF FEET

233-235. Colet House Preparatory School. The Boarding-House.
W. H. Spaull, Architect.

As it is more usual in the case of Girls' Schools to have the residential and educational buildings in one block, there will be found more examples of sleeping arrangements for Girls' Schools in the next chapter when dealing with schools in one block.

Colet House Preparatory School.—This building (Figs. 233-236) serves as a boarding house for the school illustrated and described above (Figs. 66-68). The house is arranged with dormitories and cubicles, with a certain number of ordinary rooms in addition. A noticeable feature of the building is the large provision for exit in case of emergency, there being four staircases provided to the first floor,



Second Floor Plan.

236. Colet House School.

W. H. Spaull, Architect.

and three to the second and third. The staircases, after consultation with the best authorities, were constructed entirely of oak, as being the best fire-resisting material, since it is not only refractory in catching fire, but does not give way until almost burnt through. In the basement is placed the dining-hall, next the kitchen, and approached directly from the boys' entrance through the lavatory. A long room measuring some 56 by 24 ft., warmed by two fireplaces, and repeated on the four floors, forms the day-room on the ground floor, and dormitories above. A sick-wing approached by a separate stair is arranged on the second floor. Particular care must be taken in planning a boarding house to ensure certain and easy exit in case of a fire occurring at any point. This subject is fully discussed below in Chapter XIII.

CHAPTER XI.

BOARDING SCHOOLS IN ONE BLOCK.

Preparatory School, Special Points in reference to—Playgrounds—Class-rooms—Special Rooms—Dormitories—Bedales School—St Margaret's School, Bushey—The Girls' Grammar School, Ashby-de-la-Zouch — New College, Hull — The Knaresborough Grammar School—The Bridlington Grammar School.

PREPARATORY SCHOOLS.

WHERE the school is not of sufficient size to entail the provision of separate blocks for residential purposes in addition to the school buildings, the arrangement, while of course involving much the same rooms, is necessarily somewhat modified. As a general rule Private and Preparatory Schools, being of smaller size, are arranged in one block. Although there is not much difference between the general arrangements of the buildings for a Preparatory School and for those which keep their pupils for a complete course of secondary education, it will be well to consider some of the points particularly applicable to Preparatory Schools before passing to the examples and illustrations of smaller Boarding Schools.

Private Preparatory Schools.—Private Preparatory Schools are in nearly all cases Boarding Schools, and, although in some cases they admit a certain number of day pupils, such an arrangement is usually objected to, owing to the increased chances of infection and for other reasons. The boys usually enter the school soon after passing their ninth year, leaving generally before the age of fourteen, when they go on to the Public School for which they have been preparing. The number of pupils in these schools varies from about 20 to 60 or 70, though there are of course a certain number of a larger size. The keen competition among these schools in this country, and the high fees that they are able to charge if they can show successful results, has resulted in great completeness in equipment and general efficiency, upon which indeed their very existence depends.

The playgrounds and playing fields are as a rule very extensive, and comprise in almost every case a football ground and cricket ground, besides a good deal of space for various games, such as rounders, &c. A fairly liberal average in the case of Preparatory Schools would show about an acre to every 10 boys *—that is to say, the ordinary Private School of 50 or 60 boys would have about 5 or 6 acres. Fives courts and lawn tennis courts are usually provided.† A carpenter's shop is a common adjunct, as is not uncommonly a swimming-bath. Gardens are sometimes found, but there seems considerable difficulty in arousing much enthusiasm for gardening among boys at school. A sanatorium standing some little way from the school is generally provided.

In Preparatory Schools the classes are small, and would as a rule average about 10. While in some small schools one or perhaps two classes will be held in the schoolroom or common living-room, it is usual now to find a class-room for every form. A convenient size for a class-room in a Preparatory School is found to be 18 ft. 6 in. by 16 ft. 6 in., which will allow plenty of room for movement, as it is customary at times to have the class arranged round the master in a semicircle for the purpose of place-taking—a fact which should not be lost sight of in considering the arrangement of the desks ; but it is as well to avoid what are known as "reversible desks," *i.e.*, which can be used either as a writing desk or as a seat with a back. In a room of the size mentioned, where the class does not exceed 10 or 12 pupils, there is plenty of room to provide single or double desks of the best type for writing, and to have a semicircle of forms with backs arranged for the purpose of forming the class round the master. With this addition the remarks on class-rooms for Secondary Schools will apply equally to those in Preparatory Schools.‡

Lockers.—It is necessary to supply a locker or cupboard for every boy, but not necessarily provided with a key. Sometimes these are placed in the schoolroom, or box desks are provided, or it may be only open shelves. The latter have the merit of making a certain amount of tidiness necessary, nor is it possible for things of a perishable nature to escape detection, and further it prevents the keeping of live stock in inconvenient places. At the same time it is a great hardship to a boy to have no private place where he can keep his

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* Special Reports, vol. vi.

† For plan of fives and tennis courts, see pages 259, 260. ‡ See Chapter VII.

possessions in a convenient and tolerably secure position. If possible these lockers should be put in the corridors, where they can be easily got at without disturbing the schoolrooms, unless a special room can be provided for the purpose.*

The provision of special rooms, such as a music-room, library, or museum, can hardly be considered necessary, though there should always be if possible a room where quiet reading can be carried on. If a room can be given up for this purpose, it may of course be well to combine with it the library, and also the museum if there is one.

Play-room.—In contrast to the room for quiet reading it is as well that there should be a room where at certain times unlimited noise is allowed. There seems a sort of craving in boys, especially young ones, for periods of unrestrained noise. Books on school hygiene tell us that it is necessary, natural, and most beneficial to the lungs. If there is a covered gymnasium, it may well serve for a play-room; but otherwise some outlet should be provided that will be available in wet weather and times when the playground cannot be used.

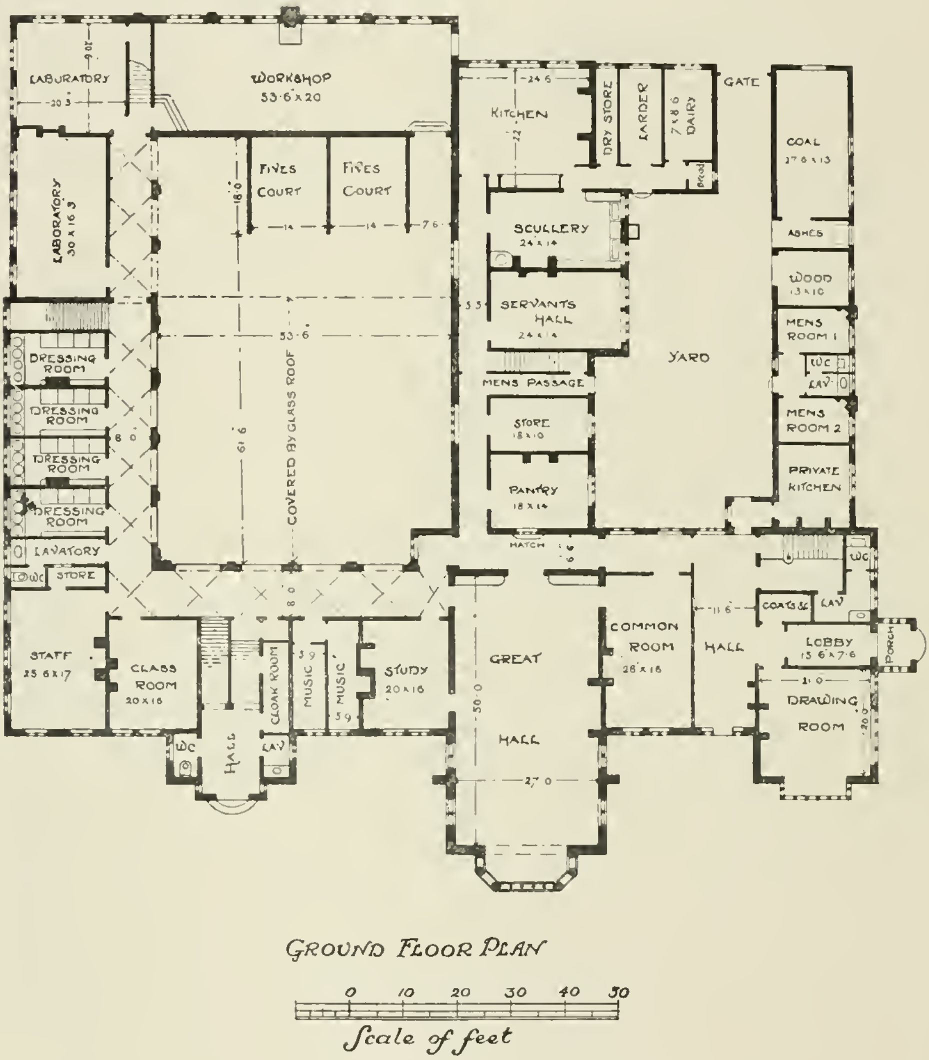
Dormitories.—The remarks and examples of dormitories given above (page 230) will apply equally to the case of Preparatory Schools. Cubicles are generally condemned for young boys. The usual plan is to have rooms or small dormitories taking from four to ten beds. Three beds should be regarded as a minimum.† In the sixth volume of the "Special Reports" issued by the Board of Education, which is devoted to the consideration of Preparatory Schools, are given the answers from 120 Private Preparatory Schools to certain questions asked them. It may be of interest to shortly summarise some of the results. The average numbers in the schools (120 answers) are given as just over 36; there is one resident master to every 8 or 9 boys, the classes usually being of that size. Nearly 70 per cent. supply a gymnasium, either open or covered; 27 per cent. show a museum; 56 per cent. a sanatorium, in a few cases not detached from the school; 18 per cent. supply a swimming-bath, but not always warmed; 76 per cent. have a carpenter's shop; 37 per cent. have fives courts and tennis courts.

* In Boarding Schools for older boys lockers or cupboards with a key are always provided.

† Special Reports, vol. vi.

EXAMPLES OF BOARDING SCHOOLS COMPLETE IN ONE BUILDING.

Bedales School.—This (see Figs. 237-240) is a large Private School for boys and girls recently erected near Petersfield in Hampshire. The

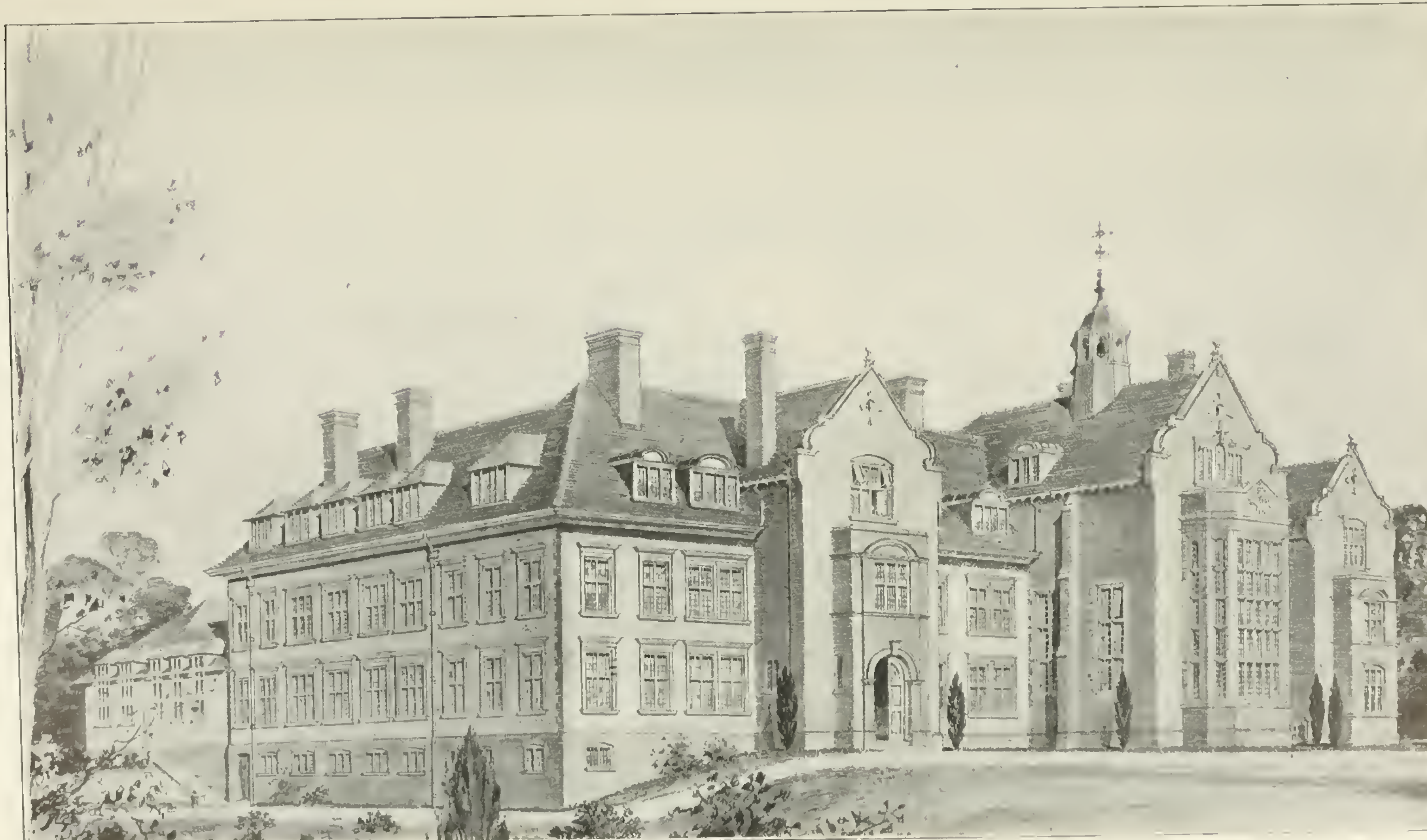


237. Bedales School, Petersfield.

E. Prioleau Warren, Architect.

school is organised on somewhat novel lines, which have already been mentioned.* Though a Private School, it is not a preparatory one in the sense of sending boys on to the Public Schools, the pupils

* See pages 15 and 16.

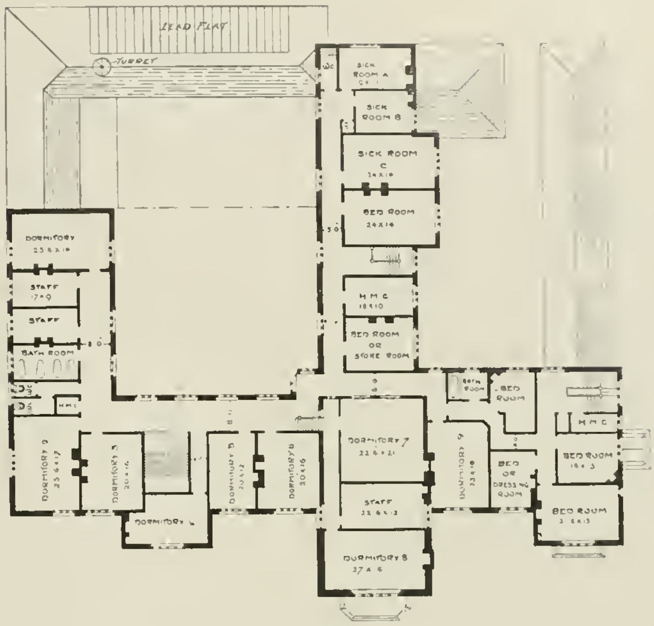


240. BEDALES SCHOOL.

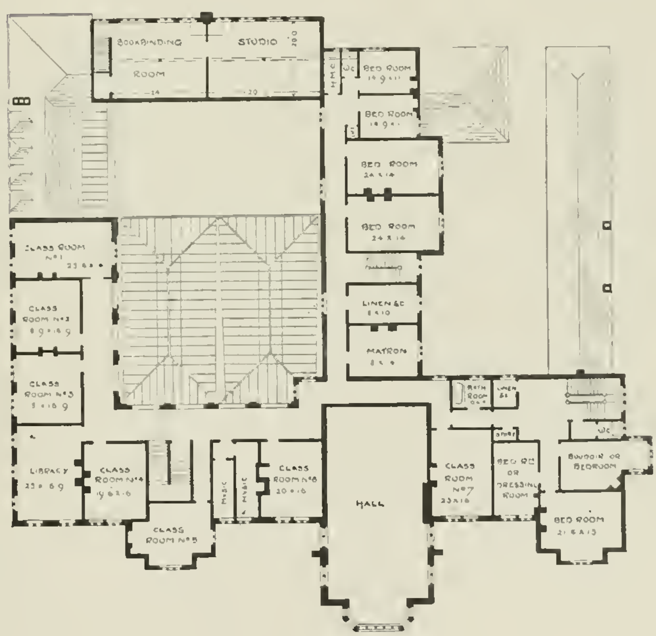
E. Prioleau Warren, Architect.

remaining in the school until they are ready to go on to College or begin their professional life. The building is the outcome of the co-operation of the Headmaster, Mr Badley, with the architect, Mr Prioleau Warren. It has been very carefully thought out, and shows several features of interest. The main object in its arrangement is to ensure that there should be thorough ventilation and a plentiful supply of fresh air and light. With this object the corridor off which the rooms open on the ground and first floors is open on one side.

The school is for boys and girls. They are educated in the same class-rooms, and are mixed together both for meals and recreation. They sleep in separate buildings, spending the whole day in the main school block. The only influence which this has on the plan is the provision of the girls' cloak-room near the



Second Floor Plan



First Floor Plan

0 10 20 30 40 50

Scale of feet

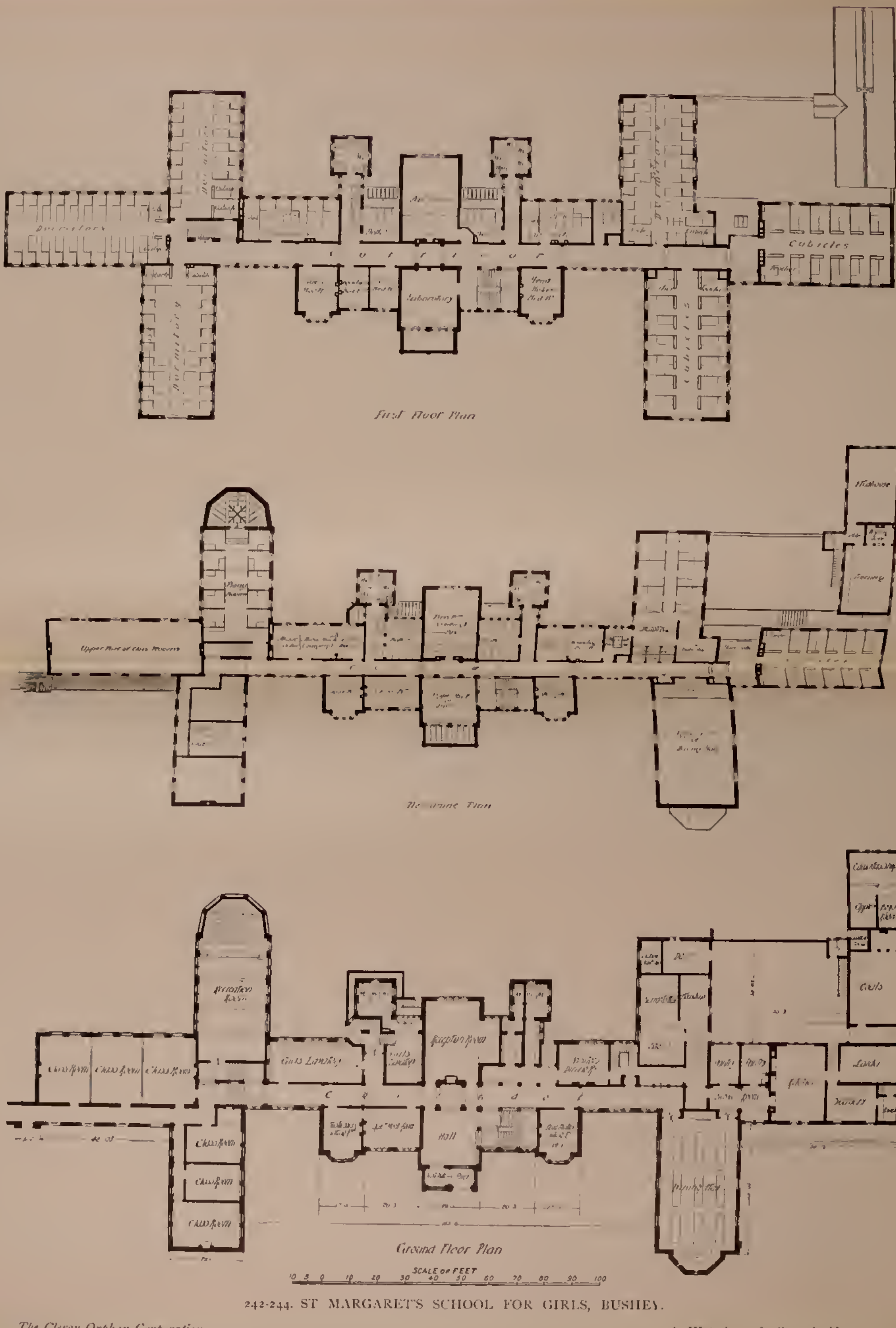
238, 239. Bedales School.

main entrance. The actual school buildings form the three sides of a quadrangle (see Fig. 237), round two sides of which runs a cloister formed of red brick vaulting. This has an extremely pleasant and effective appearance. The central quadrangle is covered for about two-thirds of its length by a glass roof, thus forming a covered playground in wet weather. On the opposite side are two fives courts. The main entrance opens directly into this cloister, leading on the right to the great hall, which serves as the living-room of the school as well as for meals. This is a large and lofty room measuring 50 by 27 ft., and is in constant use. The Headmaster's study opens off it. On this side of the quadrangle are found the kitchen and offices, and the Headmaster's private room; on the other, the room for the assistant masters and the dressing-rooms. There is an unusually liberal allowance of these required, as the whole school use them at the same time, it being one of the rules of the school that every boy changes into flannels after lunch and goes out, wet or fine. In order to provide for the great number of damp clothes that result from this system in wet weather, there is in the corner of each dressing-room a clothes-shoot in which each boy places his wet things. The shoots end in the drying-room in the basement, placed immediately below.

On the first floor a corridor is carried round above the cloister below, and is open to the air on one side. Off this the class-rooms open. On the floor above are found the dormitories for the boys, arranged to accommodate various numbers from 4 or 5 up to 8 or 10. On each floor the school part is kept separate from the servants' quarters and private part of the house. There is a large carpenter's shop, and over it a room for bookbinding and the studio. Two chemical laboratories—one for chemistry and one for physics—are also provided. A view of the school is shown in Fig. 240.

St Margaret's School, Bushey (Figs. 241-244).—This is an example of a fair-sized Boarding School for girls. This school has boarding accommodation for about 120 girls and 8 teachers, besides the Headmistress's rooms, administrative rooms, &c. The accommodation provides eight class-rooms, all of which, except two which are small and more in the nature of division-rooms, are on the ground floor, where are found also the necessary reception-rooms, dining-hall, kitchen, and offices, also a recreation-room 39 ft. by 24 ft. 9 in. The sleeping-rooms are arranged partly as open dormitories* and partly as cubicles, the largest number of beds in any room being twenty. There are two

* See page 223.



242-244. ST MARGARET'S SCHOOL FOR GIRLS, BUSHEY.

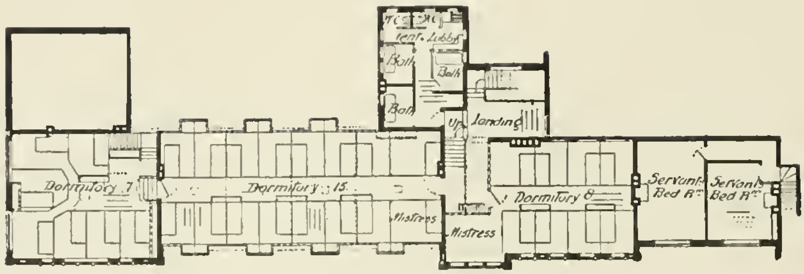
The Clergy Orphan Corporation. *A. Waterhouse & Son, Architects.*

cubicles provided in each of the open dormitories. The amount of superficial floor space provided is 66 sq. ft. The cubicles, of which there are forty-four, measure 9 by 7 ft. On each floor and in easy reach of each lot of dormitories are arranged the baths, in the proportion of about one to every seven girls. Beyond these, cut off from the main part of the building by an intercepting lobby, the water-closets are arranged in blocks of four, in the proportion of one to every eight boarders. There is a housemaid's closet in each block. The washing arrangements are placed in the dormitories and cubicles, while for day use there is a lavatory downstairs giving one basin to every five girls. Ten practising-rooms

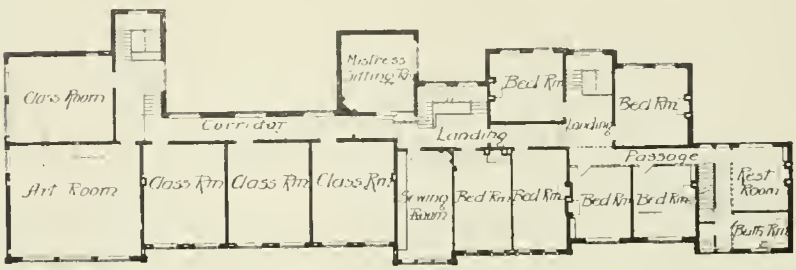
241. St Margaret's School for Girls, Bushey. Part of Entrance Front.
A. Waterhouse & Son, Architects.

with pianos are placed on the mezzanine floor over the recreation-room, three rooms being supplied for piano-teaching, a room of larger size being provided in addition for singing-lessons.

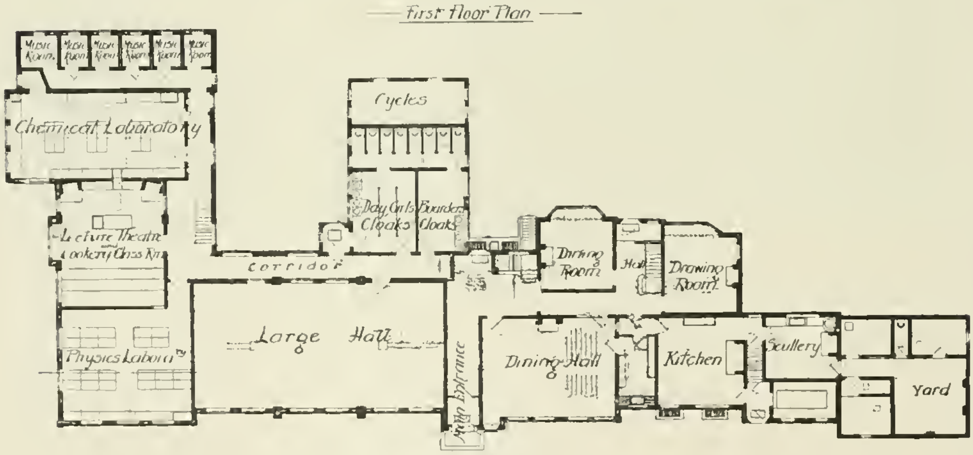
The top floor, with the exception of the studio and chemical laboratory, is given up to the dormitories. These rooms are so arranged in every case that windows can be placed both sides, and thorough ventilation assured. The sleeping accommodation for the servants is arranged by a large room divided into small cubicles opening off a special staircase, with the housekeeper's room close to the entrance. The use of the mezzanine floor is worthy of notice. By this means,



— Second Floor Plan —



— First Floor Plan —



—— Ground Floor Plan ——

245-247. Day and Boarding School for Girls, Ashby-de-la-Zouch.

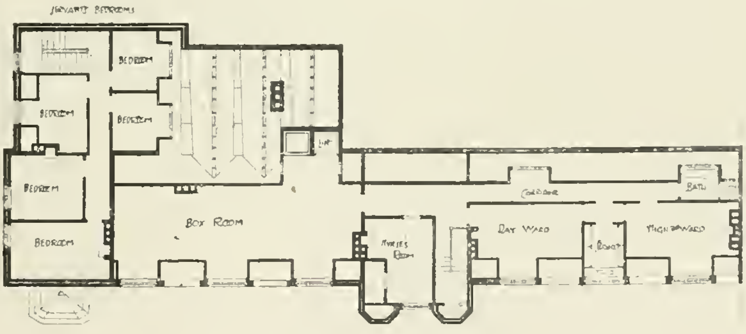
Barrowcliffe & Alcock, Architects.

while making it possible to give plenty of height to those rooms on the ground floor where it is necessary, such as the dining-hall, recreation-rooms, and the class-rooms, full advantage is taken of the space which is obtained by grouping on this floor all the rooms in which it is not essential that there should be much height.

248. New College, Hull.

Hall, Cooper, & Davis, Architects.

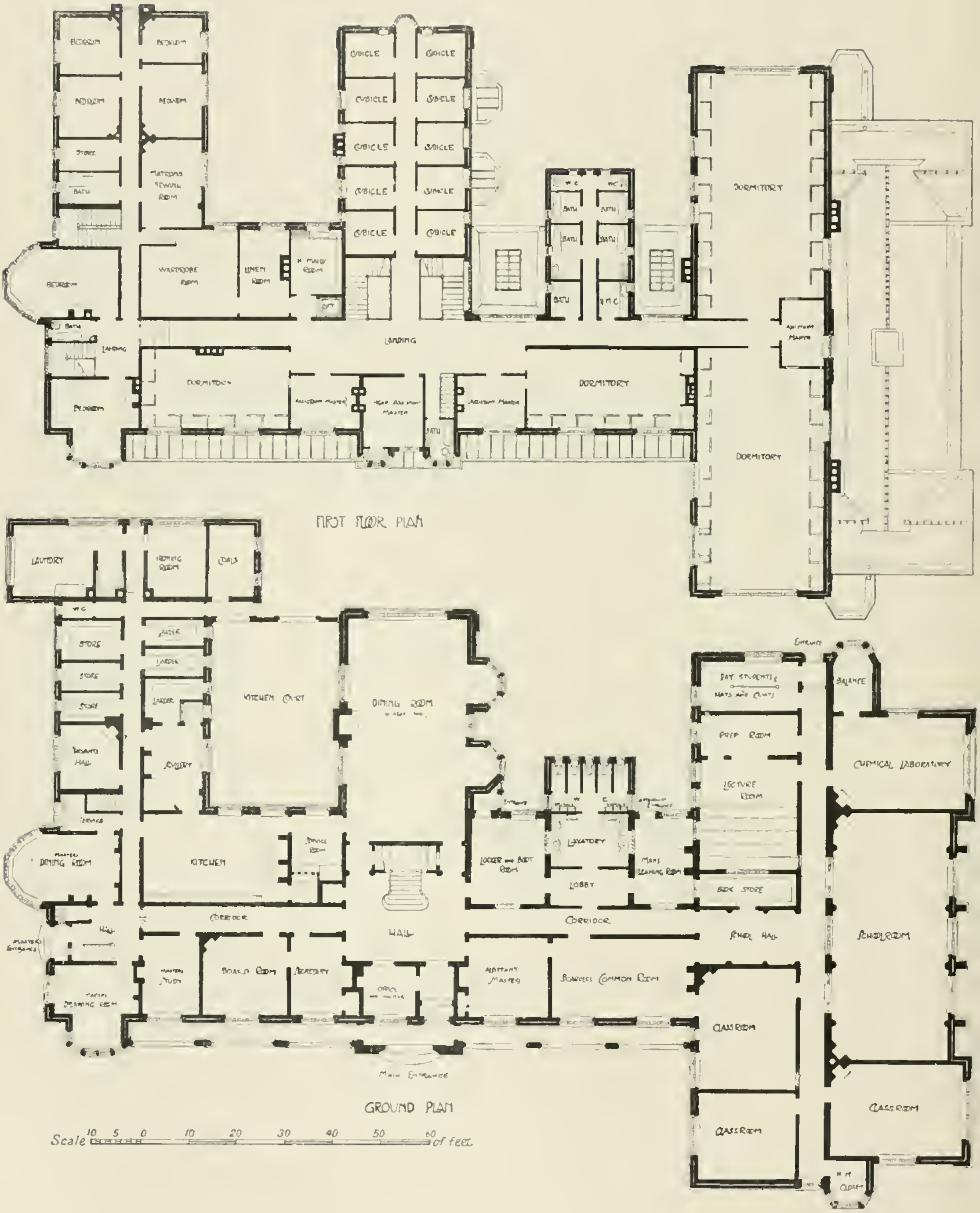
The Girls' Grammar School, Ashby-de-la-Zouch (Figs. 245-247).—The next example shows a similar kind of school on a somewhat smaller scale, the residential accommodation only taking 30 to 40 girls, but there are in addition to these a number of day scholars. In this plan the somewhat unusual plan of placing the chemical and physical laboratories



249. New College, Hull.

with the lecture-room on the ground floor has been adopted, the class-rooms being placed on the first floor. The dormitories are fitted with cubicles.

New College, Hull.—This building (Figs. 248-251) combines in one



250, 251. New College, Hull.

Hall, Cooper, & Davis, Architects.

block a master's house and boarding arrangements for some 60 boys in addition to the educational accommodation. The building is planned so that the master's part of the house is separated from that of the boys, the kitchen being common to both parts. On the east side of the main entrance are placed the assistant masters' room and the boarders' common room, these rooms having a southern aspect. The latter room measures 29 by 17 ft., and is fitted with bookshelves, &c., so arranged that in addition to serving as a recreation-room it can be used for working in during the evening instead of the large schoolroom. To the north of the entrance is the large dining-room. This is intended to provide room for 100 boys, and has two bay windows overlooking the sea. The large schoolroom measures 52 by 24 ft. It has a fireplace at each end, in addition to which are supplied hot-water radiators. There is a locker-room with a locker for each boy, with a separate entrance from the playground. On the first floor are two dormitories containing seventeen beds, so arranged that one master can overlook both. Two smaller rooms containing nine beds are also so arranged that supervision can be maintained. It will be noticed that the plan of having a small part screened off at the head of each bed described above * has been adopted. Ten cubicles measuring 9 by 10 ft. are also provided. On the top floor, in addition to the servants' room and a large box-room, there is arranged a completely isolated sick-ward, consisting of a nurse's room, a day ward and a night ward, bath-room and service-room. The box-room has a lift coming directly from the entrance hall. A view of the exterior of the building is shown in Fig. 248, the materials being local red brick with stone dressings.

The Knaresborough Grammar School (Figs. 252, 253).—This plan shows a somewhat curiously shaped building. The sleeping accommodation is entirely arranged in cubicles 7 ft. 6 in. by 6 ft., two assistant masters' rooms being arranged to command the view of the corridors between the cubicles. On the ground floor are arranged the class-rooms, chemical laboratories, and a large manual instruction room. The residential house for the master is placed at one end, and is cut off from the school part of the buildings.

Bridlington Grammar School.—Figs. 254-256 show this school, a compact and well-arranged building, having accommodation for some 60 to 70 day boys and 25 boarders, as shown on the plan. The building has, however, been recently added to, so as to complete the original scheme, which makes the hall the central feature of the buildings.

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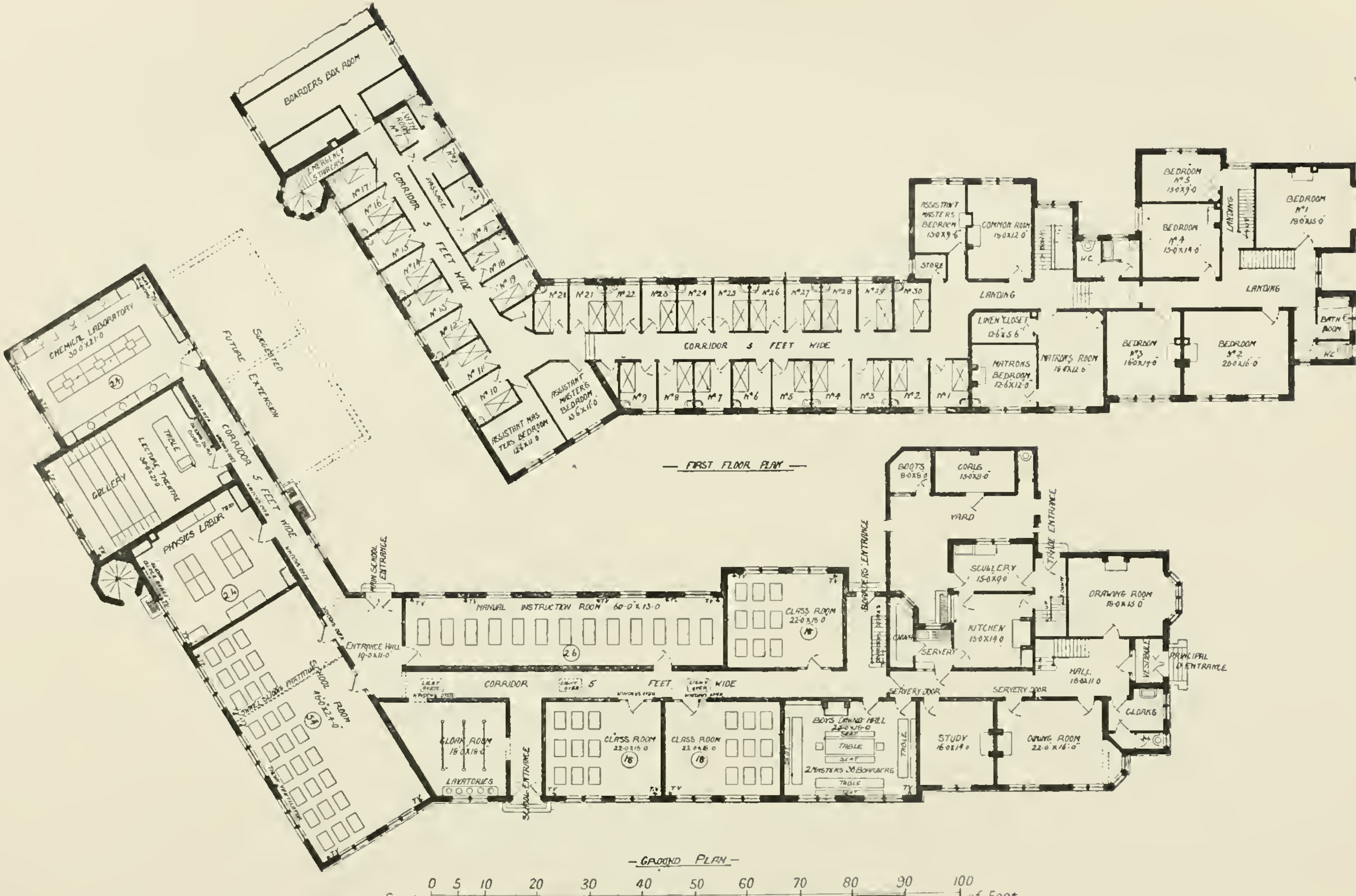
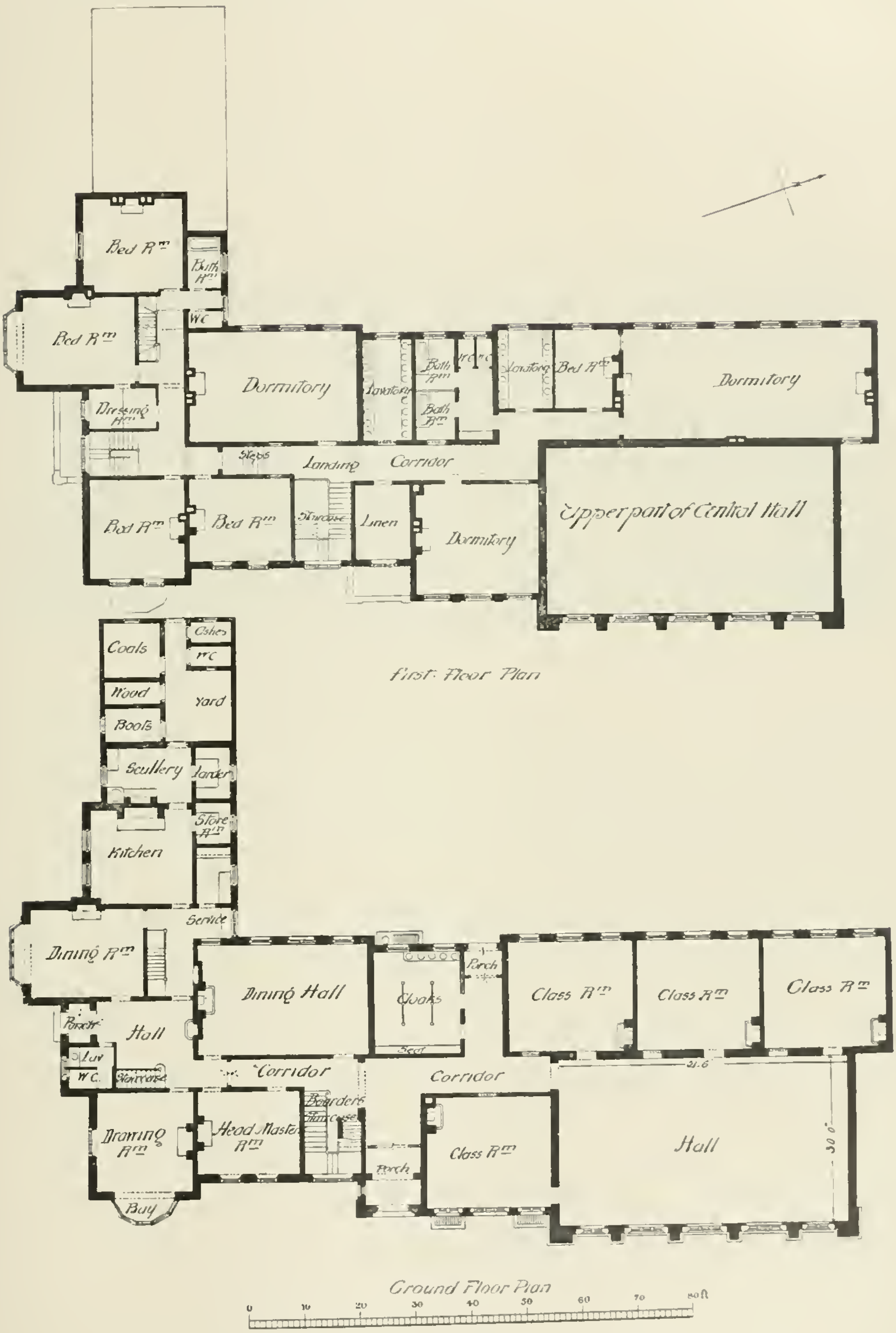
* See page 224.



252, 253. The Knaresborough Grammar School.

Barrowcliffe & Alcock, Architects.



254, 255. THE BRIDLINGTON GRAMMAR SCHOOL.

Botterill, Son, & Bilson, Architects

This is shown in the exterior (Fig. 256). The additional buildings comprise further class-room accommodation, with science laboratories and lecture-room. The class-rooms measure 22 by 20 ft. ; and as it is not intended to have classes of more than 24 at the most, ample floor space is provided. The dormitories are placed over the class-rooms on the first floor. The basins for washing are not placed in

256. THE BRIDLINGTON GRAMMAR SCHOOL.

Botterill, Son, & Bilson, Architects.

the dormitories, but in special lavatories. The grounds of the school comprise some 30 acres.

For further examples of Boarding Schools and Preparatory Schools, see—

The Builder.—42, 23, 100, 293, 325 ; 67, 25, 59, 100 ; 68, 376 ; 69, 314 ; 70, 472 ; 74, 280 ; 81, 214.

The Building News.—41, 296 ; 53, 320 ; 59, 320 ; 62, 203 ; 64, 767 ; 66, 849, 888 ; 67, 8, 40, 72, 749 ; 73, 221, 581 ; 76, 672.

The British Architect.—49, 166 ; 50, 200 ; 51, 348.

CHAPTER XII.

BOARDING SCHOOLS

(Continued).

Infirmaries and Sanatoria—Amount of Accommodation necessary for Infectious and non-Infectious Illnesses—**Sanatoria**—Rooms required for, and their Arrangement—Example of—**Infirmaries**—Arrangement and Example—**Provision for Games**—Amount of Space to be provided—Cricket Grounds—Table showing Area required for different Games—Fives Courts, Description and Illustration of—**Gymnasia**—Requirements of, and Size required for Schools of different numbers—Material for Floor—Apparatus required.

INFIRMARIES AND SANATORIA.

IN Boarding Schools, especially those in which the numbers are large, the suitable provision to be made for illness becomes a question of great importance. The cases arising fall generally under three heads—Infectious diseases, accidents and severe illnesses of a non-infectious nature, and slight ailments. All that is required for the last class can be managed by having in the boarding houses one or two quiet rooms away from the dormitories and general rooms of the house.* For the other classes it is generally demanded that every school should have two separate buildings—an infirmary for accidents and non-infectious cases, and a sanatorium where cases of infectious diseases can be effectually isolated. This of course entails a double staff, and the maintenance of two establishments, and except in the case of large schools is often found too costly. Dr Clement Dukes † maintains that, provided proper care be taken in the planning, and sufficient precautions maintained in its use, that one building can be made to serve the two purposes. But there is no question as to the advantages of having a separate building for infectious cases only.

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* In the new buildings for Christ's Hospital, Horsham, there is no provision for any sickness in the boarding houses. Any boy who is ailing in any way is sent at once to the infirmary close to the school.

† "Health at School."

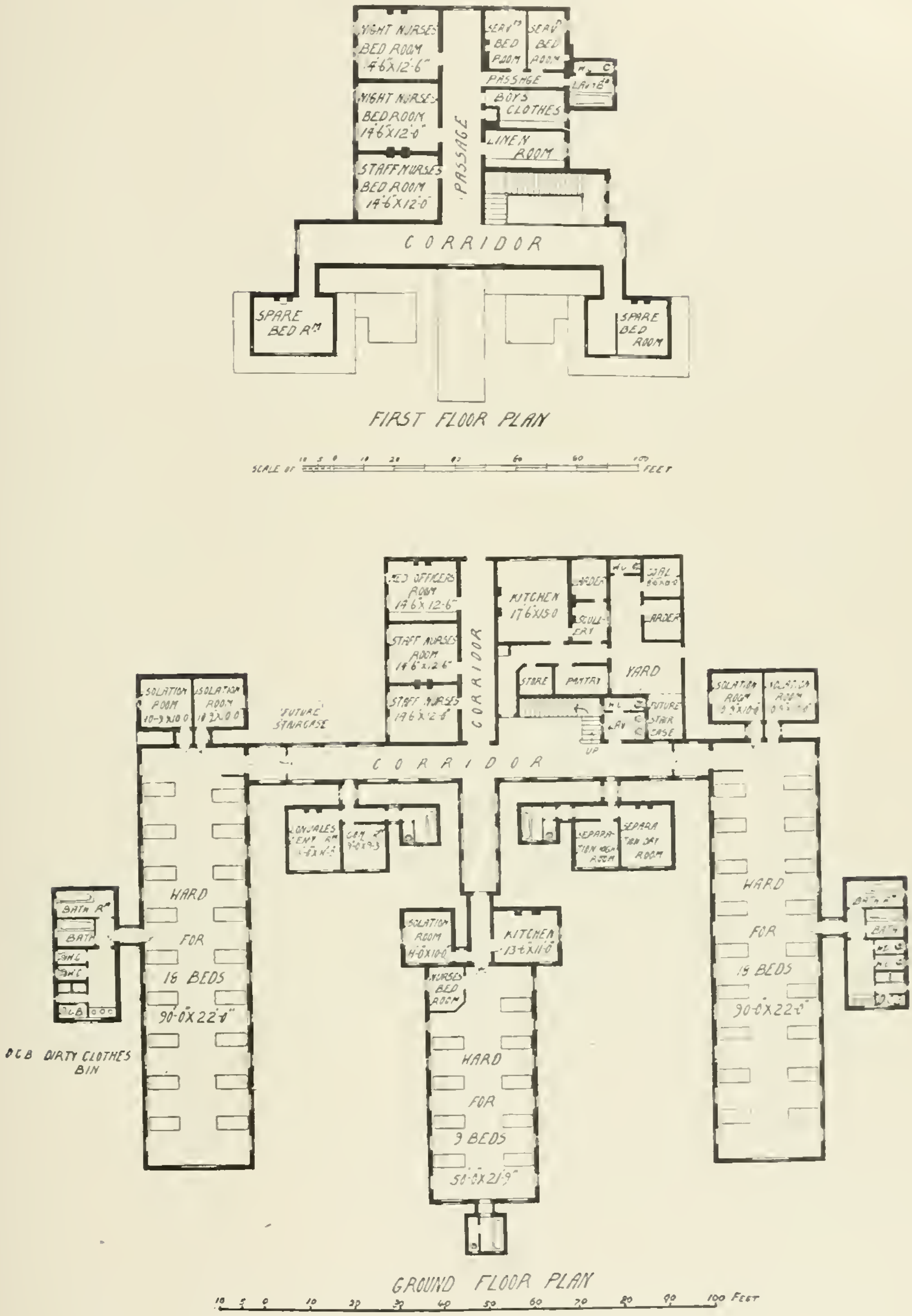
Amount of Accommodation necessary.—This varies slightly according to the ages of the pupils. The Council of the Medical Officers of Schools Association* give the following suggestions as to the numbers of beds to be provided. In schools where the average age is over fifteen years, for non-infectious cases 6 to 7 per cent., for infectious diseases 20 per cent. This is on the supposition that cases of measles are treated in the sanatorium. If not, 10 per cent. should be deducted. These figures, which make a total of 25 to 27 per cent. of beds to be provided, would mean, in the case of a large school, a very large outlay and heavy expense in maintenance. In the case of a bad outbreak of infectious disease in a school it is probable that even 20 per cent. would be unequal to the strain, and that some emergency arrangements would have to be made, while for ordinary school life the provision would be far in excess of the requirements. Dr Dukes in his book on School Hygiene, when discussing sanatoria, reckons that when children are congregated in large numbers there should be provided 20 per cent. where the average age is under thirteen, and 15 per cent. where over thirteen;† but a less number will be required where the school is split up into separate boarding houses.

This number would include both classes of cases, infectious and ordinary complaints. On the whole it will generally be found that a provision of ten beds for every hundred boarders will, where the school is divided into separate boarding houses, be a sufficient provision. This is the number that has been adopted in some recently erected schools. For the infirmary, where there is no arrangement of sick-rooms in the boarding houses, there should be a provision of 5 per cent. It is, however, more usual to have one or two rooms arranged in the houses where trifling ailments can be treated, or isolated if an infectious complaint is suspected. In this case less provision is required in the infirmary.

Sanatorium.—The accommodation necessary will comprise, in the Administration Department, medical officer's room, matron's room, kitchen, offices, linen store, servants' rooms and store-rooms, and extra

* Treatise on Hygiene and Public Health, Stevenson and Murphy, vol. i., p. 756. 1892.

† Owing to the great increase of sanitary knowledge and methods of protection against infection, a very large proportion of children come to school without having had the usual diseases incident to childhood, so that when an epidemic does break out it is more likely to spread now than in the old days, where a large proportion of the school would already have had the disease.



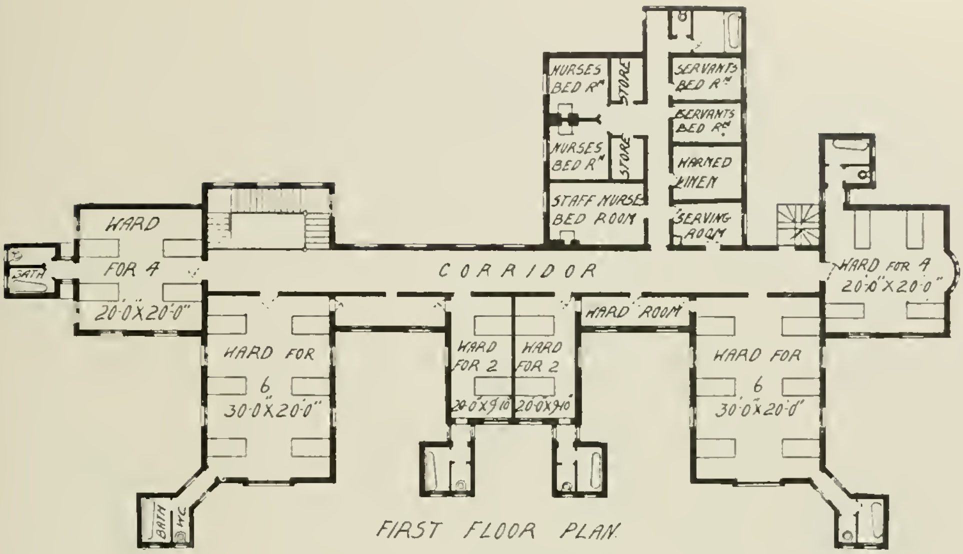
257 258. A SCHOOL SANATORIUM.

B. Champneys, Architect.

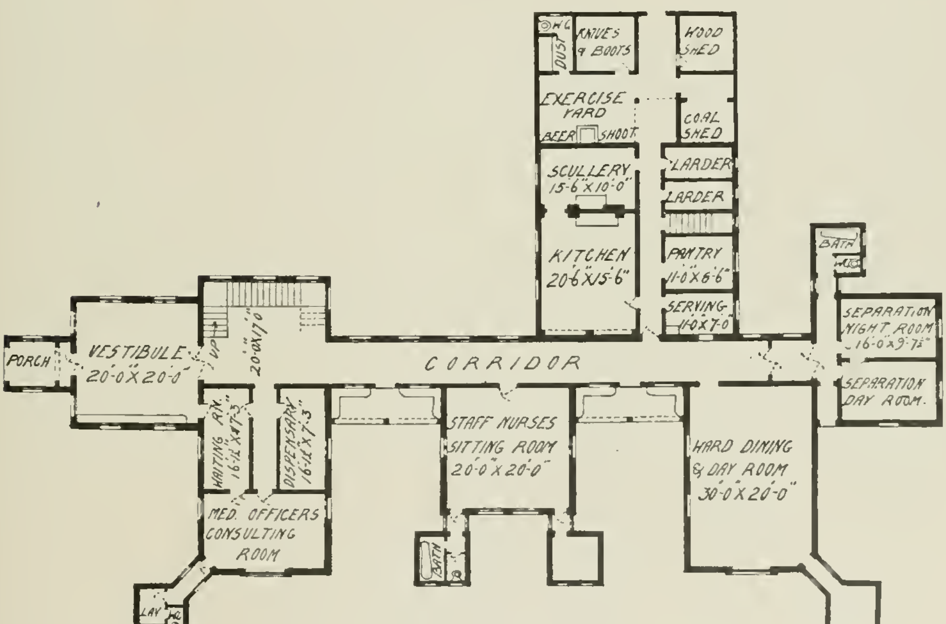
bedrooms in case of additional nurses being required. At least two general wards, in case of there being two infectious diseases in the school at the same time ; a certain number of single-bedded isolation-rooms ; a convalescent room, and necessary accommodation for the nurses on the staff. Bath-rooms and lavatories must be arranged in connection with the different wards and rooms—of course effectually isolated. It should be remembered that some arrangement should be made so that a boy leaving the sanatorium to return to the school may be able, after his final disinfecting bath, to get out without entering any part of the building again. Casement windows coming down to the ground in the bath-room can be made to answer this purpose. A disinfecting apparatus should be found in every school sanatorium. A plan of a school sanatorium is shown in Figs. 257 and 258, from a design by Mr Basil Champneys. This is intended for a school of 500. It will accommodate 50 boys in three wards, and five single isolation-rooms. Two of the wards contain eighteen beds. This is rather a larger number than is considered advisable by many authorities. They measure 90 by 22 ft., giving a floor space of 110 sq. ft. Each ward is arranged so that it can be isolated from the rest of the building.

Infirmaries.—The school infirmary need not be placed at any great distance from the rest of the school buildings, provided that it is well out of the noise and bustle. A number of small rooms are required here rather than large wards, in order that there may be ample means of classifying diseases, and keeping separate any boys suffering from contagious diseases such as ringworm. A consulting-room must be supplied for the medical officer, so that the boys can come here, when suffering from slight ailments, for advice. A dispensary is usually provided as well. Figs. 259 and 260, of which Mr Champneys is likewise the architect, show a method of arranging a school infirmary. It has accommodation for 24 patients, arranged in six different wards, taking from two to six beds.

It has not been possible to go into detail as to the construction and fittings of sanatoriums and infirmaries, as this would involve questions which lie far outside a book of this sort, and which properly come under the head of hospital construction. At the same time, as such buildings form so necessary a part of a school, and as school architects are usually called upon to design them, it was considered as well to include plans of each, with a few general remarks.



FIRST FLOOR PLAN



GROUND FLOOR PLAN

259, 260. A SCHOOL INFIRMARY.

B. Champneys, Architect.

PROVISION FOR GAMES.

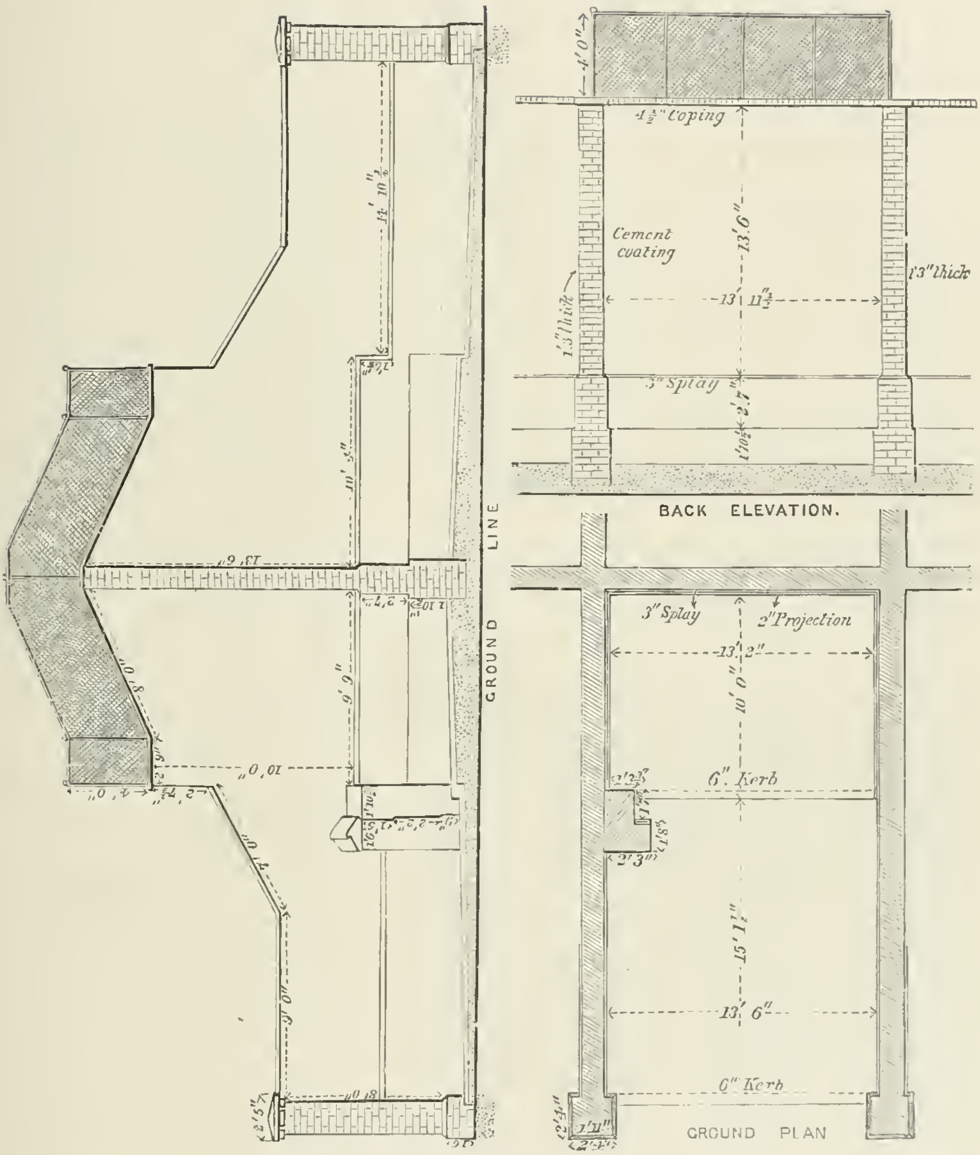
In estimating the area required for the site of a school, the extent of the provision that is to be made for games has to be settled. In Boarding Schools, where the whole of the recreation time of the pupils has to be provided for, a large extent of ground is necessary. In Day Schools it is not possible to put the same pressure upon boys and girls not naturally fond of games, and who prefer to be at home rather than to come back to the school and play. In many schools games are either compulsory by the rules of the school, or practically made so by the boys themselves. In any case there should be ample provision made in the way of space. In a large school there will be the regular playing fields for cricket, football, &c.; in addition to this there is required a considerable area of playground in and round the school buildings. The amount of space devoted to this should be larger if, as is sometimes the case, the playing fields are some little way off.

It is hardly possible that any general rule could be made as to the area necessary; it comes practically to as much as can be got, the resources of the school settling the limit, as the cost of keeping a large area in order is considerable. From 15 to 20 acres for every hundred boys will probably supply sufficient room for playing fields for all games, since a large part of the cricket ground is used for football or other games in the winter. There is appended a table giving the measurements required for different games. For cricket, of course, there are no exact limits, but for a single ground from 4 to 8 acres will give the limits of a small and a large ground, but at school the cricket grounds are not divided as a rule into separate grounds. Generally speaking, there are one or more large playing fields, and while one piece, probably in the centre, may be kept sacred for matches and the play of the senior boys, the other games are played all over the ground, the pitches being placed at sufficient distances apart to avoid, if possible, any chance of danger.

TABLE SHOWING SPACE REQUIRED FOR DIFFERENT GAMES.

Cricket - -	Say 8 acres for each 100 boys.
Football (Rugby) * -	110 by 75 yds.
Football (Association)	Maximum, 200 by 100 yds.; minimum, 100 by 50 yds.
Hockey - -	109 by 50 yds.

* This is the limit size.

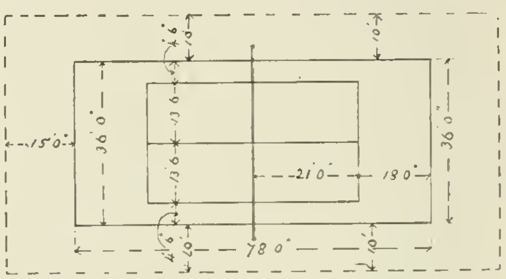


261-263. A Fives Court.

From the "Badminton Library."

Lacrosse	- -	Length between goal posts—maximum, 150 yds.; minimum, 100 yds. Boundaries as arranged.
Rounders	- -	Diameter of circle posts, 25 to 30 yds.; ground required, 1 to 2 acres.
Lawn tennis	- -	With sufficient margin (see Fig. 264), 108 by 56 ft.
Croquet	- -	30 by 40 yds.
Basket ball	- -	100 by 50 ft.
Badminton	- -	40 by 20 ft.

Fives Courts.—As fives courts are so common and so excellent an addition to school buildings, and as the form of the court, at least that form of it known as the Eton Court, is a rather complicated building, it has been thought as well to give details of its construction. Figs. 261-263, reproduced by permission from the "Badminton Library," show the different parts of an Eton Court. If this form of court is adopted, it is essential that it should be accurately built to conform to this, the usual standard. As regards the number of courts that should be supplied, it will be found that, if the game is at all popular, two or three for every hundred boys will be required. The Rugby Fives Court is similar, but with all projections, buttresses, steps, &c., omitted. In many cases a back wall is added. In this case the court will serve equally well for the game known as squash racquets. Fives courts now form a fairly common feature in Girls' Schools, the Rugby form being usually adopted. Fives courts have been added to several schools belonging to the Girls' Public Day School Company, and have proved very popular. It is necessary now to supply hardly less room for play in Girls' Schools than in the case of those for boys, for, though football is not played, hockey, which is a popular and widespread game, requires as much space. Cricket, too, is being successfully tried in many schools for girls.*



264. A Lawn Tennis Court.

* See Special Reports, vol. ii.

GYMNASIA.

A gymnasium is usually found in Secondary Boarding Schools, and in most cases in Day Schools ; but it is hardly regarded with the same importance in this country as in Germany, where in every school of whatever grade there is invariably a well-equipped gymnasium. It is undoubtedly of more importance in that country than here, where games, at all events in the Higher Schools, play so important a part. A gymnasium is sometimes placed in the basement in Elementary Schools (see for example Fig. 340, p. 361), but the position is not a very satisfactory one, and is forbidden by the Prussian regulations as to school buildings. German writers strongly recommend a separate one-storeyed building connected with the school by a covered way. It is, however, recognised that a gymnasium can be easily and economically formed in the roof. Provided that care be taken to render the floor sound-proof, the result is quite satisfactory. See Fig. 265 of an example of such a gymnasium from a school in Elberfeld, and in Fig. 266 of a similar arrangement in an American School.

265. A Roof Gymnasium, Elberfeld.

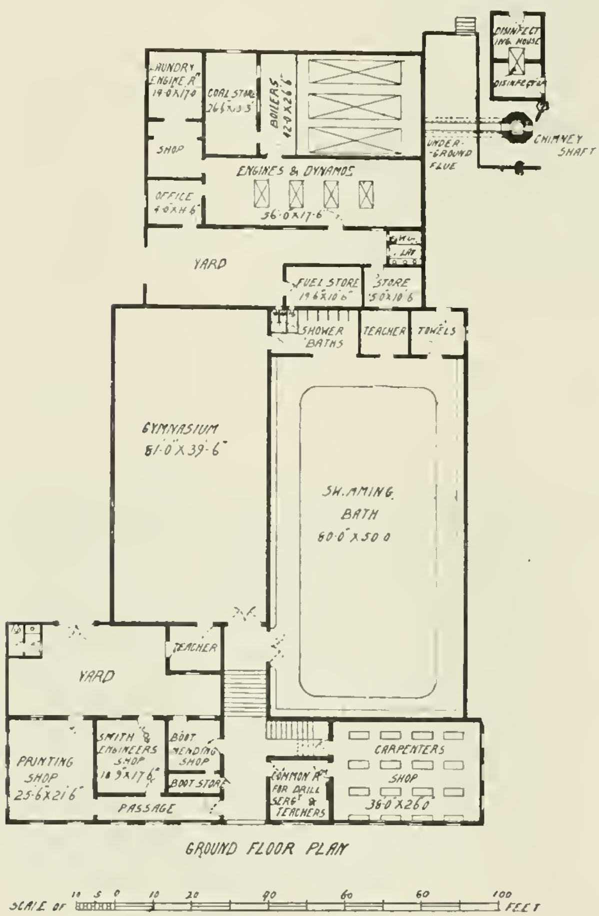
266. A Roof Gymnasium in an American School.

Size required.—There should be plenty of room provided to allow of a considerable amount of movement. An allowance of 20 to 25 sq. ft. per head of the largest number that are likely to be using it at once is not too large an allowance. The following dimensions are

given by Hittenkofer* for pupils above the Elementary School age. These measurements are the same as those laid down by the Prussian regulations in 1870.

For 50 - - - -	31 by 51 ft. 6 in.
For 75 - - - -	36 by 67 ft.
For 100 - - - -	41 ft. 3 in. by 72 ft.

These are of course fairly liberal measurements, and in the large town schools in Germany the gymnasia measure from 65 to 80 ft. in length, and from 30 to 40 ft. in breadth, giving an allowance of 25 to 30 sq. ft. per head. In Würtemberg only 20 sq. ft. is required.†



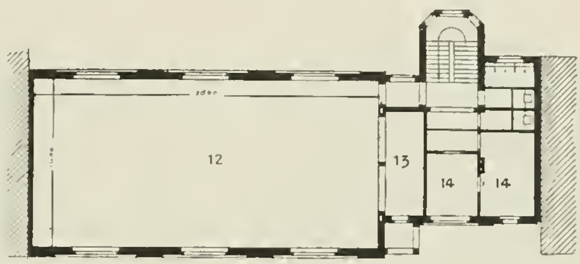
267. A Gymnasium and Swimming-Bath.
B. Champneys, Architect.

It is usual to build gymnasia of one storey only with an open roof, to the timbers of which the appliances can be hung. The Munich building instructions suggest a building with two floors, the lower room being fitted with all usual fixed apparatus, while the upper room of the same size would be kept clear for marching and other exercises. In the large German Schools it is very common to supply a double gymnasium (see Fig. 158) for the two sexes, in order to get the requisite amount of physical training into the ordinary school hours. In such cases it is recommended that the dividing wall should be movable.

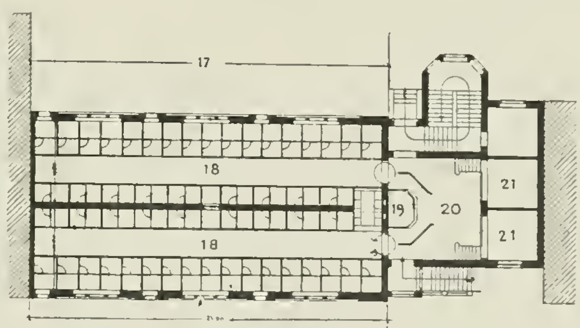
* Der Schulhausbau. † Schulhygiene, Baginsky.

The fixed apparatus is placed near the walls or grouped in order to allow as large a space in the middle as possible. In Germany it is sometimes customary to allow a free space 7 or 8 ft. wide all round the room to allow of marching. Some convenience should be arranged either in a small vestibule or otherwise, so that pupils can change into their gymnastic shoes without bringing dust into the building.

Changing-rooms, lavatories, &c., ought to be supplied with access from the gymnasium, so that those using the building have not to go outside when heated from exercise. A common and convenient plan in large schools is to combine the gymnasium and swimming-baths in a separate building (see Fig. 267). Figs. 268 and 269 show the plan of a gymnasium in Elberfeld.* In this case the lower part of the building is fitted with ranges of shower-baths that can also be used by children from the neighbouring Elementary Schools, and also by the general public. A gallery is provided over a recess which forms a convenient place for the storage of apparatus. The gymnasium attached to the Girls' High School in Liegnitz is shown in Figs. 270, 271. Here, again, a gallery is provided over the entrance vestibule, apparatus-room, and waiting-room. The gymnasium has a flat ceiling, and on the top floor are arranged the living-rooms for the school-keeper. A room is required for the gymnastic instructor. The building should of course be warmed, but great care taken to see that the temperature does not rise too high. The ventilation should be as free as possible.



First Floor.



Ground Floor.

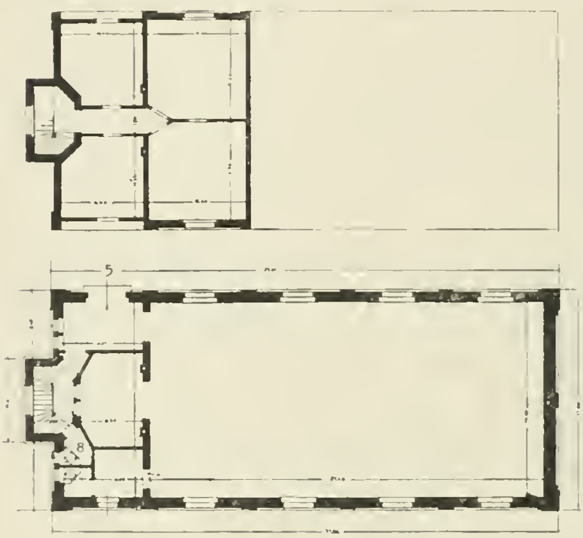
268, 269. Plan of Gymnasium and Baths, Elberfeld.

12. Gymnasium. 13. Apparatus Store with Gallery over. 14. Rooms for Gymnastic Teacher. 17. Playground. 18. Shower-baths. 19. Pay Box. 20. Hall. 21. Waiting-rooms.

The material for the floor is of importance. It should be some-

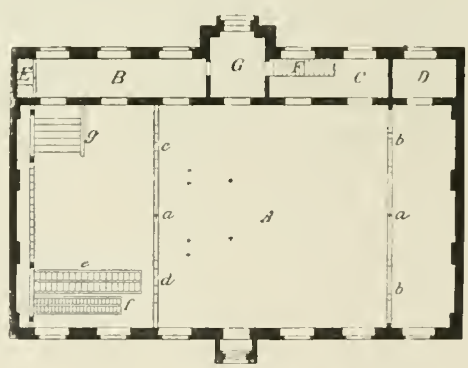
*Taken from Turnhallen by Stadtbaurat Schönfelder of Elberfeld.

thing that will neither wear slippery, or from which dust can be easily kicked off. It should not be too hard and solid, but should be to some extent elastic, and should have sufficient resonance to respond to a sharp tap of the foot. If of wood, it must be secure against any tendency to come off in splinters. Cement and asphalte have most of the above objections. Where expense has not to be considered, an excellent floor can be made of narrow oak boards tongued together, with the joints caulked. Well-laid oak parquet is good, but lacks the resilience of the boards. Where boards are used care should be exercised to see that all the nailing is properly hidden. Asphalte covered with linoleum will be found to give a satisfactory result.



270, 271. Gymnasium of the Girls' High School, Liegnitz.

One of the most difficult things to provide against is the dust. Of course the better the ventilation the less it will be felt. In order to prevent the dust accumulating too much, it is recommended that the floor and apparatus should be wiped with a damp cloth daily. The mattresses used for jumping are of course a fruitful source of dust. These ought to be covered with leather on both sides, and frequently beaten in the open air. They should not be dragged about the floor. Cocoa-nut matting especially holds the dust. There are various methods used for quickly laying the dust that has been stirred up, by means of hand instruments that throw a fine spray of liquid.



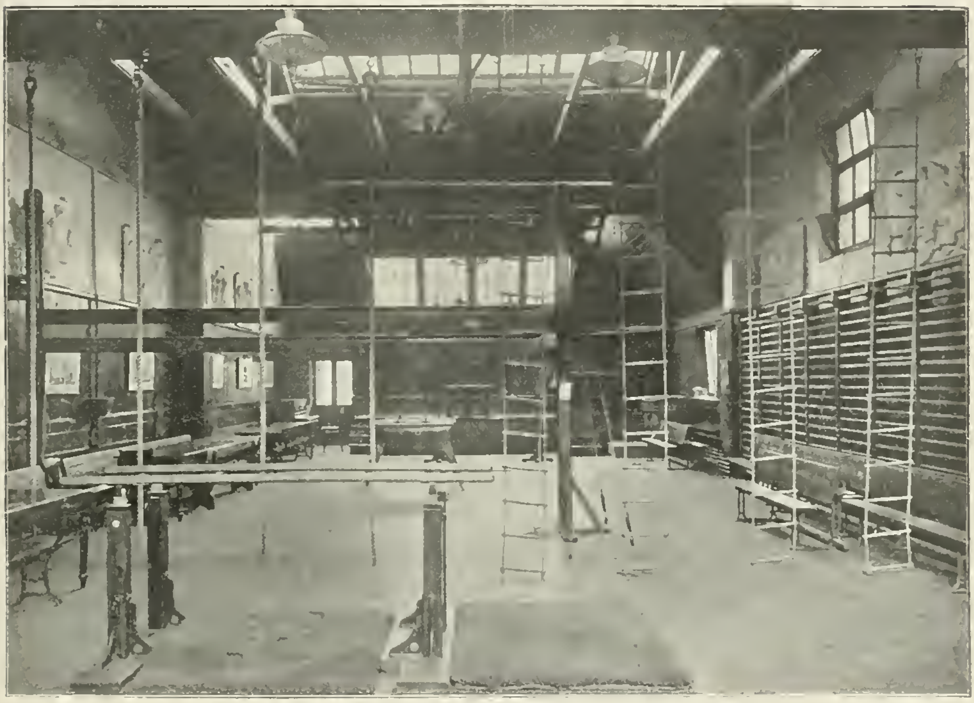
272. A Gymnasium.

A. Gymnasium. *B*. Cloak-room. *C*. Apparatus. *D*. Instructor's Room. *E*. Offices. *G*. Entrance. *a*, *a*. Running Course. *b*, *b*. Fixed Horizontal Bars. *c*. Trapeze. *d*. Rings. *e*. Horizontal Ladder. *f*. Sloping Ladder. *g*. Climbing Poles.

Apparatus.—The appliances for which provision has to be made are :—

Parallel Bars.—Usually about 9 ft. long and 20 in. apart. They are often made adjustable as to height for school use. For adults they are generally about 4 ft. from the ground.

Horizontal Bars.—These are adjustable to heights varying from 3 to 7 ft. from the ground. It is often convenient to have them made so as to be easily movable, small plates being fixed in the floor to which the stays can be fastened.



273. THE GYMNASIUM, KENSINGTON HIGH SCHOOL.

The Girls' Public Day School Company.

Vaulting Horse with a Spring Board and Mattresses. Bridge or horizontal ladders suspended 6 or 7 ft. from the floor. Hand rings having a diameter of 5 to 9 in., hung in pairs about 18 in. apart, at a height of 3 ft. 6 in. from the floor. These rings are also used hung singly at a distance of some 5 or 6 ft. down one side of the gymnasium. Swinging trapezes, the height and distance from the floor depending upon the age and attainments of the pupils. There are of course the various appliances for climbing, inclined ladders and ladder planks, ropes

both with and without knots. A piece of apparatus generally found in gymnasiums attached to Girls' Schools is the beam. This is a stout piece of wood fixed horizontally between the supports placed some 8 or 10 ft. apart. The horizontal part is made adjustable to height. It is not uncommon to find one of the upright posts for this fixed to the wall, while the other is arranged so that it can be easily moved and taken away when not required.

In Fig. 272 is shown the plan of a Berlin * gymnasium upon which the position of the apparatus is marked. An interior view of a gymnasium in a large Girls' School is given in Fig. 273.

* Schulhygiene, Baginsky. 1898.

CHAPTER XIII.

THE PROTECTION OF SCHOOL BUILDINGS FROM FIRE.

NOTE.—*The bulk of this chapter is reprinted by permission from "School World,"* 1904.

School Buildings particularly liable to Fires—Dangers of Fire-proof Buildings—Fires in Day Schools; in Boarding Schools—Means of Escape—Hand Fire Engines—Chemical Fire Engines—Apparatus that every School should have—Causes from which Fires originate—Arrangement of a New Building—Staircases—Means of Checking the Spread of Fire—Value of Sound Timber Construction—Water Supply—Hydrants and other Apparatus—Value of regular Drill and Practice.

FIRE has an extraordinary attraction for boys, who generally have a box of matches about them ready for any experiment. In the schools where boys have studies, cocoa is brewed over spirit lamps; contents of waste-paper baskets are burnt as a convenient method of emptying, while reading after lights are out by means of candles concealed in various ingenious ways, and so on, bring the risk of fire nearly up to that of a dangerous factory.

No school should be without the means of promptly and effectually dealing with small outbreaks, or to be so arranged that there is not easy and certain escape for all the inmates in whatever quarter the fire may happen to break out.

One of the great dangers of fire lies in its comparatively rare occurrence. A serious fire occurs to some school, and at once all other schools, stirred by a sense of their own insecurity, hastily invest in apparatus. Fire drills and practices are set on foot; but before very long, as no fire comes, things slip back gradually into the old routine. The lessons of the calamity are forgotten, the new apparatus deteriorates, the fire drill enthusiastically carried out while an attractive novelty is abandoned, the staff and the inmates change,—then upon the outbreak of a fire the buckets are empty, the hose full of holes, and no one knows where anything is kept or what to do, confusion results, and the first few minutes when the fire could have been easily coped with are lost, and serious damage, if not danger to life, results.

Another danger lies in a trusting reliance upon a few buckets or

small chemical fire engine, or in the fire-proof character of the building. With regard to the latter point it cannot be too strongly borne in mind that fire is, and, as far as can be seen at present, always will be, a possible contingency whatever form of construction is used or whatever materials are employed. No building is really fire-proof, and recent experience in America to some of the so-called fire-proof buildings has brought home with terrible emphasis the danger of trusting to construction. Nothing can be said to be really fire-proof, and, though a building may be constructed of highly refractory materials, there will still be enough combustible matter to suffocate the inmates; and it is in the smoke and gas produced that the real danger to life lies. Prompt and energetic treatment in the early stages of a fire, provided that the few and simple requirements are kept ready to hand, will in nearly all cases be effectual; and if the building has been properly constructed of slow-burning materials, arranged so that the fire can be confined to the immediate neighbourhood of the outbreak, the damage caused by fire can, in most cases, be reduced to a very small quantity.

With regard to Day Schools, the problem, as far as actual danger to life is concerned, is simple, and a properly arranged fire drill carried out at frequent intervals, and tested by an occasional experimental alarm, say once in three months, will practically ensure the safety of those in the building. A few simple rules should be observed: Care should be taken to have a clear arrangement as to which classes are to go down each staircase, and the order in which they are to go, the younger children naturally going first; it would be as well that this list should provide for clearing the school in case one or other of the staircases were stopped. The London Education Committee direct that this order of going out in case of emergency should be hung up in each class-room. Where there are roof playgrounds a special drill should of course be practised. The alarm should be given by the school bell, supplemented, if not loud enough, by a policeman's whistle. It is as well that the school-keeper should have orders to close at once the gates in case of fire, except in the case of a very small playground, to guard against an inrush of excited parents and others.

It is essential that the alarm should be occasionally rung without the knowledge of any one in the school, so that teachers and children may be accustomed to a sudden alarm, as the accidents due to panic are the real source of danger, and safety lies in the knowledge and experience that every one can get out of the building in a few moments.

In boarding-houses means should be taken not only to provide

means of escape, but some method of arousing the inmates before their faculties are deadened by smoke must be provided. This is of especial importance in the case where boarders sleep in separate rooms. Automatic fire-alarms are now made in various forms that can be set to a high degree of accuracy; the initial cost of these is not very high, and it does not seem too much to ask that they should be provided. Perhaps the safest precaution of all is a watchman, provided that means are taken to ensure regularity in his rounds; but this could hardly be expected except in large institutions.

As a means of escape from a building when the staircases are cut off, there is probably nothing better than the canvas chute as made by Messrs Merryweather. It can be used by any one, young or old, weak or strong; from ten to twenty can come down it in a minute; it can be easily fitted to any window, is not expensive, and is always ready for use. It is of course essential that practice in the use of the chute should take place occasionally; there is little danger in this if precautions are taken to avoid any risk of cutting or slitting the canvas. Accidents have resulted from a cut made by a projecting nail in a boot, and it is as well to make a rule that boots should be taken off before using the escape. In use, if there is no one below, the first person goes down checking his pace by projecting his elbows and knees against the sides of the chute. This is far easier to do than it sounds. He then holds the end of the chute for the others, pulling it to one side if fire is issuing from the windows below. It is probably not necessary at the present time to emphasise the danger of having windows barred; every room must have a second means of exit, by the window in case of necessity.

In order to deal with small outbreaks of fire every building should be provided with a sufficient number of small, portable, hand fire-pumps. The best pattern is that carried on the London Fire Brigade engines. These cost only £3. 10s., can be operated by one person, and throw a strong jet of water some thirty feet; this gives sufficient force to make the water effective, as the force with which the water is thrown is of far more importance than the amount—it "knocks" the fire out. It is probably not too much to say that about half the fires in London annually are extinguished with these hand-pumps; every fire engine carries two or three; the firemen carry them into the house and put out the fire. Each of these pumps, which should be distributed about the house in convenient and accessible positions, should have three or more buckets hung by it, so that, while one person operates the pump, others keep filling it up with the buckets. The pump should be worked with

short sharp strokes, and kept about three parts full; the water in it and the buckets should be changed once a week.

These water hand-pumps are, on the whole, much to be preferred to any of the many forms of portable chemical pumps. The chemical engines have undoubtedly been very successful in putting out small fires, especially in trained hands, but it is hardly safe to rely upon them. They cost some shillings to charge, so that they are not likely to be used for practice; servants are often afraid of them; they are useless if they fail to put the fire out straight off; the chemicals do a considerable amount of unnecessary damage in the case of a very small fire. If unused for any length of time they are likely to corrode and get out of order; and finally, the result is hardly more effective than a jet of plain water thrown with force from a plain water-pump, which can be filled as fast as it is used. Their chief use is to throw a jet of liquid without any manual power being required; but this is more than counterbalanced by the difficulty of bringing them into action, and the necessity of a supply of chemicals to recharge them, which would be an awkward matter to do in the excitement of a fire, even if the necessary ingredients were ready at hand.

The following apparatus might well be kept ready in easily accessible positions in every building:—One or more portable force-pumps, according to the size of the house and the number of inmates, cost £3. 10s.; extra length of pipe to each, £1. Three or more buckets always kept full of water by each pump. One canvas chute for each dormitory, or, at all events, to each floor, cost from £7 to £10, according to height of floor. In addition to these there should be kept in a convenient spot a hatchet to break open a door, or to get at a fire under the floor; a long-handled hook to pull down burning curtains, &c.; a thick blanket, and some lengths of rope. A light ladder to get to the roof should be kept on the upper floor, if there is no other access.

The really important points are frequent practice and regular trial and inspection of the apparatus. In the case of high buildings, where there are large numbers of inmates and an insufficient supply of staircases, it may be necessary to put up outside iron staircases, either leading directly to the ground, or, in some cases, to a neighbouring roof, whence the ground can be easily reached. The arrangement of these naturally depends entirely on the nature of the particular building. It should be remembered that, when a fire does break out, the doors and windows should be, as far as possible, kept shut in order to cut off the supply of air.

As so many fires arise from causes that a little care and foresight would prevent, it may be of use to suggest a few of the more common ways in which they are caused.

If the school is in a very old building there are certain points that should be carefully looked to :—Defective flues—this is particularly the case if wood has been used for fuel at any time, owing to the corrosive action upon the mortar by the pyroligneous acid formed ; timber built into flues, or used to support the hearth stones. Wood becomes highly inflammable if allowed to remain in contact with hot brickwork or pipes for any length of time, owing to the facility with which it absorbs oxygen as soon as it becomes a little charred. Exposed timber on a roof is a great source of danger ; snow boards will often accumulate soot, and sooner or later a spark may fall upon it. Fires are often caused by the sun's rays focussed by means of some glass instrument, or a bottle of water standing in the window. There are, of course, all the dangers connected with carelessness on the part of servants and others, with lamps, candles, matches, drying linen, putting away kitchen utensils with fire still adhering to them, raking out fires at night, &c. Schools have, of course, in addition to all the ordinary risks, those due to the character of their inmates as suggested above ; and no school can be considered properly equipped or well managed that does not provide the necessary apparatus for protection in case of fire, and insist upon regular practice in its use.

The important point, of course, is to provide for the certain escape of the inmates, and in the design of a new building the point should be kept clearly in mind.

A school building should, for reasons of light and air, be so free from neighbouring buildings that it ought not to be in any danger of fire from adjacent houses. In cases where there are buildings that might conceivably be a source of danger it should be remembered that the windows are the vulnerable points, so that any windows so placed should have fire-proof shutters ; wired glass will, if the windows allow of its use, be found an effective barrier.

The building should be so schemed that no part of it can be cut off from a staircase in case of fire ; that is to say, the staircases should be at each end of the building, in addition to any that may be required in the middle, as in the case of a large school, so that, wherever an outbreak occurs, none of the occupants can find themselves with the fire between themselves and the staircase.

Direct and easy access should of course be arranged to the stairs and exits, taking care that there should be plenty of room at the foot of

the stairs. If these discharge at right angles into a corridor unless of considerable width, or close to the door of a class-room, there is a likelihood of dangerous crushing in case of panic. The staircases should continue right up the building, and are safer if constructed in the form known as "boxed," that is, with a wall up the centre. This is, however, sometimes objected to on the ground of appearance, and also that it renders supervision more difficult. In America it is common to find an emergency staircase leading from the upper floors directly in to the playground, which is not required or used in ordinary circumstances. A square staircase, leading right up the building and lit by a skylight or lantern at the top, is a great danger in case of fire ; it acts as a gigantic flue to supply the air.

An important consideration to be borne in mind during the planning of a building is that of providing against the rapid spread of a fire when once started. In a school which has to be arranged with the view of allowing for the rapid and easy movement of large numbers, the difficulty of cutting off the different parts is of course considerable, and it would be hardly possible to provide fire-proof screens and curtains for confining a fire as far as possible to the immediate neighbourhood of the outbreak. A brick wall, however, is one of the most effective barriers against the spread of fire, and, as far as can be managed, internal partitions should be of brick, and continued right up the building from the basement to the roof. The ease with which upper walls can be carried on iron girders, and so not necessarily placed over a wall below, tends very much to give fires a chance of spreading.

Recent experience in regard to fires taking place in so-called fire-proof buildings points to the fact that such buildings have, in case of fire, an element of danger that has to be added to that belonging to a building of the ordinary construction, for though built to a large extent of materials that are themselves practically incombustible, and in this way of course tending to make an outbreak of fire less likely, yet behave very treacherously when once a fire has got a footing. The stone staircases crack and break off, the iron expands and twists, pushing out the walls, the concrete floors collapse, and falling on to the floors below not only do great damage, but render the work of the firemen more difficult and dangerous.

The materials to be selected are those that are as little as possible subject to expansion and contraction under rapid changes of temperature, such as timber, bricks, and mortar, and good plaster. At a recent Fire Prevention Congress, held in London in July 1903, great stress was laid upon the value of sound timber construction, especially in the

case of floors. A well-made floor with the ends of the joists well bedded in the walls, flooring boards not less than one inch thick well tongued together, the spaces between the joists filled with pugging, and the under side coated with plaster one inch thick on wire laths, will resist the action of fire either from above or below for a very considerable time, only giving way when burnt right through. Although the use of timber in the floors may to some extent increase the smoke, this does not amount to anything of great importance, since everything else in the room, the hangings, &c., must be well alight before the floor begins to burn.

Stud partitions covered with lath and plaster and hollow in the middle are extremely dangerous, acting as a ready channel for the fire from one point to another; nor is there any necessity for their use now that so many different kinds of solid and fire-proof partitions are to be obtained.

Staircases of stone, although generally recommended as a fire-proof construction, should not be used unless they can be placed in a well apart from the main building. As pointed out above, stone stairs are very untrustworthy when exposed to heat; being for part of their length built into the wall the expansion is bound to be unequal, and they are apt to snap off at the point of junction when exposed to heat. A staircase made of hardwood, such as oak or teak, with its under side coated with plaster, will remain in position and serviceable long after it has been impossible for any human being to go up or down it, and even if it does catch alight the first jet of water will make it passable again; heat sufficient to set alight such a staircase would either break off stone steps or render them impassable. In a large Preparatory School built not long ago the staircases in the boarding-house were made of oak, after consultation with the fire-brigade authorities, as the safest method of construction. A safe and satisfactory form of stair can be constructed out of concrete, with solid two-inch treads of teak or oak.

When using timber in buildings as a form of fire-proof construction it must of course be only in substantial form, well protected, and care taken to avoid any exposed edges.

The arrangement of the fireplaces and flues is of course a matter of extreme importance, particularly in the case of wooden floors; care should be taken to see that the wooden centring is removed from the small arches that carry the hearth stones. A better plan is to carry these on concrete, carried the full depth of the floor with the plaster applied directly to the under side of the concrete. Flues, unless surrounded with a full nine inches of brickwork, should have fireclay

linings. A danger in the case of buildings warmed by means of air brought in over hot pipes may be mentioned here. It often happens that on a mild day in winter all the registers are closed, in which case the temperature inside round the pipes rises dangerously high; some of the registers should be made so that they cannot be closed, in order to ensure a movement of air.

In providing the apparatus for a building it is of importance that it should be selected and made to suit the particular building, water supply, &c. Competent advice from a fire engineer should be obtained while the scheme of the building is still under consideration; much additional expense and loss of efficiency is caused by leaving, as is often the case, the question of fire protection until the building is nearing completion. The usual appliances consist of fire mains supplied with their water either from a water company's main or from a tank in the roof, having hydrants or firecocks on each floor, with the necessary hose and nozzles attached to each hydrant.

The water supply is of course the first importance, and until this has been satisfactorily arranged for it is of little use providing the other apparatus. It is not possible to enter upon the question here, but it may be pointed out that the water, to be of any real use, must be under considerable pressure. A tank in the roof will give but a small head of water to the hydrants on the upper floors, and unless the jet is thrown with force it is not of much effect as a fire-extinguishing agency. In order to meet this difficulty, there has lately been brought out an ingenious piece of apparatus called a "pressure augmentor," which occupies but little room, and is easily worked by hand or driven by an electric motor or other power. By means of this a very powerful jet of water can be obtained where the pressure in the mains is too small to be of any real use. In a large building there should be one or more large supply pipes or mains running right up the building, with an ample supply of plain hose on each floor so arranged that any point of the building can be easily reached.

In addition to this supply of hydrants for a severe outbreak there should be on each floor a small hand fire-pump, as already described, for use in case of a small fire discovered in an early stage, and so to avoid the damage of a large stream of water.

The fire mains are best made of cast iron, and the internal diameter should not be less than three inches; they should be properly coated with composition to prevent rust. The choice of the hydrant requires care, as it must be so made as not to be liable to freeze or to stick; the thread of the screw should not be too fine or it will be very liable to

damage from a chance blow. With regard to hose, the only form that is at all durable is leather ; this has the drawback for use inside a building that it is not quite water-proof, but any form of canvas hose treated with indiarubber to make it impervious is very short-lived, the rubber deteriorating very rapidly ; plain canvas hose is less water-proof than leather and liable to mildew and rot.

Of great importance are the various forms of drill and practice in the use of the apparatus supplied. The proper method of using the hydrants and hose requires instruction and practice, and the staff of the building ought to be taught their use. Many of our larger schools have a fire-engine and a fire-brigade composed of boys in the school, the members of which might well be instructed in the use of the fixed apparatus as well as in the use of the engine. The question of fire-fighting lies outside the scope of these remarks, which only aim at giving some suggestions as to the precautions to be taken and the apparatus to be kept, so that if an outbreak should occur the means for dealing with it effectually and promptly may be at hand, and to ensure at least, if the building itself cannot be saved, that at all events there shall be no loss of life.

Finally, the greatest danger to which all fire apparatus is exposed is that of disuse and its consequent deterioration. The only way to guard effectually against this is to insist upon a periodical inspection and trial of apparatus. The manufacturers of fire apparatus have recognised this fully, and made arrangements to test and inspect the apparatus they supply at stated intervals, and also to carry out drills and give instruction to the members of the staff of the building.

Chapter XIV.

ALTERATIONS AND ADDITIONS, ETC.

Alterations and Additions to existing Buildings — Conversion of Dwelling-houses for School Purposes—Questions of Accommodation—Warming and Lighting—Some Notes upon the Cost of Schools—The Care of School Buildings.

The question of adding accommodation to an already existing building, or the alteration of some antiquated arrangement in order to conform with modern requirements, is one which is of course continually arising in connection with school work. But while it is one full of interest, and one which offers full scope to all the skill and ingenuity the architect may possess, it is hardly one upon which it is possible to find any definite rules. The additional accommodation required has generally been fully determined by experience. The question to be decided is the most economical and convenient method of getting what is wanted. This is of course so completely dependent upon the buildings already existing that it seems doubtful whether there would be any real utility in giving examples of such alterations. It need, however, be scarcely pointed out that it is in this sort of work that a knowledge of school routine and work is of great value, since it is often by changing the purposes of some rooms, and by altering the sizes and positions of others, that the additional accommodation is partly gained. The practical effect of such changes can hardly be gauged without a knowledge of the working of the school. The architect has, again, to steer a delicate course between the idea of what is wanted as seen by the principal of the school and what is regarded as absolutely necessary by the governing body of the school, who have to keep an eye on the financial side of the question, and who may not take quite so optimistic a view of probabilities of increase in numbers.

The disadvantages arising from the use as a school of a building originally intended for a dwelling-house are many and obvious. The rooms seldom correspond to the required sizes for the classes, and so involve classification of the forms rather by the capacity of the rooms than by the attainments of the scholars. The staircases and

passages are as a rule awkward and impossible to supervise, and the rooms difficult to ventilate. The use of houses for this purpose is, however, at times a necessary expedient, either as a temporary measure during the rebuilding of a school, or in order to test the advisability of building a school in a particular neighbourhood, if not as a permanent arrangement.

The first question that arises, after the preliminary point as to whether there are any objections on the part of the landlord or otherwise to carrying on a school in the building has been settled, is with regard to the number of pupils that can be put into the house. This is by no means an easy matter to calculate. To take the dimensions of the different rooms, and after reckoning the amount of floor area to divide by the number of square feet to be allowed to each pupil, will not give an accurate idea of the number that can be properly placed in each room. First of all, it is unlikely that the lighting will be sufficiently distributed to make it possible to place desks all over the room. The position of the fireplace, again, makes a considerable difference. If placed, as is usual, in the middle of one wall, a certain amount of space is wasted, unless the position of the windows will allow of the desks being placed to face the fire. Unless the door into the room happens to come near the teacher's end of the room, a wide gangway has to be left for entrance and exit. The possibility of providing sufficient cloak-room and lavatory accommodation is one of the important points in forming an opinion as to the suitability of a house for the purpose of a school. This is of especial importance in the case of Girls' Schools, where a large provision of cloak-rooms is necessary.* If the house has a large and fairly high basement, it is usually convenient to provide the cloak-rooms there. Otherwise the difficulty may be got over by scattering the cloak-rooms about the building, utilising dressing or other small rooms unsuitable for any other purpose. The floors of course require careful looking to, as they may not be strong enough to stand the movements of large numbers. The stairs too may have to be strengthened, and care taken to see that the banisters are capable of withstanding the sudden strain of a number leaning on them at once.

It is unusual to find any provision for the ventilation or the admission of air in a private house, so that it becomes necessary to put in a number of inlet ventilators such as the Sherringham. Especially is this the case when the open fires are used, for, unless

* See page 131.

some precautions are taken, there are sure to be complaints of the draught from the door to the fire, from those sitting in a line between them. In the case of sash windows the ventilation can of course often be obtained by the use of Hincke Bird's arrangement for obtaining an inlet of air between the sashes (see Fig. 453). In case of rooms with windows coming down to the floor, such as French casement windows, it will add much to the comfort of the pupils to board up the lower part to a height of 3 ft. or 3 ft. 6 in., not only to prevent the reflections from the floor if that happens to be polished, but to guard against the strong and unpleasant draughts that are sure to arise in cold weather.

It will generally be necessary to supply additional warming. The fireplaces, which are quite sufficient for a dwelling-house in which the few people who occupy the room can group themselves round it, are not usually capable of properly warming the farther corners of the room. The larger rooms and those on the north side of the house will in every case have to be provided with some form of additional heating. It will usually be found that this can be most conveniently done by the use of the small pipe medium pressure apparatus. The pipes are small and can be taken almost anywhere, and can be arranged with less damage to the building—an important consideration if reinstatement has to be ultimately undertaken. The installation of the hot-water apparatus, the expense of which is not very great, will enable the cloak-rooms to be kept warm and the clothes dried. Also the hall and passages can be kept up to a fair degree of warmth, and so add very materially to the comfort and pleasantness of the school.

The want of good lighting in the rooms is one of the strongest objections to the use of an ordinary dwelling-house as a school, for, although the rooms may appear bright and well lit, it will probably be found that, when the desks come to be put in, there are certain places in the room where the light is by no means sufficient. If the numbers can be limited so that the desks can all be grouped in the part of the room where the light is good, the objection will not of course be felt. This is not often possible in practice, it being usually found necessary to squeeze desks into every available corner. Unluckily, the light can seldom be improved without large and expensive alterations. Verandahs and other obstructions to the light, such as boxes to hold venetian or sun blinds, should, if not absolutely necessary, be cleared away. The few inches so gained at the top of a window make a great difference in the light. Overhanging branches of trees should if possible be removed. Glass panels in the upper part of doors may assist in lighting corners and passages inside the building, which,

though light enough for an ordinary house, are often too dark for school purposes.

It is unusual to find a house with any room of sufficient size to serve as an assembly hall, though it may happen, if the house is a large one, there may be a music-room or ball-room which will answer the purpose. In cases where the house is taken to be used permanently as a school, it will probably be found best to build on an assembly hall, in which case it is generally possible to combine with it a few class-rooms, cloak-rooms, and lavatories. Great care has to be exercised in providing a convenient access. This often takes the form of a corridor, since the erection of such a building close to the original house may block too many windows. Such corridors should be well and carefully heated, so that they may, if of sufficient width, say 9 or 10 ft., be made of considerable use, benches for wood-carving, museum cases, &c., being placed in them. In cases where the additional buildings can be added directly to the existing house, it is of considerable importance that there should be a way through made on the upper floor, if the additions consist of more than one floor. Neglect of this precaution involves a long journey when it is necessary to get from the top of one building to the upper floors of the adjoining house. Where structural alterations are undertaken, it is worth bearing in mind the possibility of taking away a floor: for instance, on a bedroom floor, which, having nothing but attics over, is itself too low to be used for school work, by taking out the attic floor and putting a skylight in the roof an excellent room can sometimes be obtained for a studio or science-room. The removal of the joists cannot, however, always be done with impunity in an old house. It sometimes happens that a house may be found that offers exceptional facilities for conversion into a school, and that by fairly extensive and well-planned additions a commodious and satisfactory school building can be obtained. In one case of this kind in which a Girls' School had been very successfully adapted from a large private house, the Headmistress maintained that such a building was actually preferable to a specially-built school, on the ground of its home-like appearance and the absence of the bareness and monotony so often found in school buildings. This suggestion would, however, be better met by a more careful and artistic treatment of the design of new buildings, a point to which attention has already been drawn,* than by taking and adapting an old house. While there are still many schools carried on in ordinary

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* See page 29.

dwelling-houses converted to the purpose, it is not a method that is likely to find much favour in the future. The high standards demanded now on questions affecting the health of scholars will render it necessary that all schools of any size should be carried on in buildings specially constructed and properly fitted for educational work.

THE COST OF SCHOOL BUILDING.

The cost of school building has undoubtedly risen considerably in recent years. This is of course due to some extent to the general increase in the cost of building of all kinds, but also, and to a much greater degree, to the rise in the standard of buildings and equipment. This is more particularly noticeable in the case of Secondary Schools, in which the diminution in the size of classes, the provision of a class-room for each form, laboratories, art-rooms, &c., have raised the cost of building very seriously, so that it is not uncommon to find the cost of a Day School rising to £70 per head or even more.

Elementary Schools.

The Board of Education, which previous to the passing of the Act of 1902 had to sanction the applications made by the School Boards for loans for the erection of schools, laid down as a general rule that the total cost of a building scheme, exclusive of cost of site, legal expenses, &c., should not exceed the sum of £10 per head of the number to be accommodated. This sum proved, as the cost of building increased and the standard of building rose, to be hardly adequate, and certain additional allowances were made for the provision of central halls, or rooms for special instruction, &c. Mr Bailey, architect to the late School Board for London, and now to the London County Council for Educational Work, gives some figures as to the cost of school building in London in a paper * read to the Royal Institute of British Architects. He pointed out that every care was taken to keep the cost as low as possible, and that the difference between a building devoid of all architectural features and built of nothing but stock brick with slate roof, and one in which care had been taken to treat the arrangement with some attention to style and material, was less than 5 per cent.†

* The Planning and Construction of Board Schools, May 1899.

† This point is made by an American writer on school buildings who gives the same relative proportion. "The percentage of excess of cost between a school designed with regard to architectural effect and one of purely utilitarian construction is not great. Under ordinary conditions, satisfactory architectural results may be obtained at an increase of not more than 5 per cent. above that of the most 'practical' construction" ("School Architecture," E. M. Wheelwright, New York, 1901).

The example quoted by Mr Bailey was that of the Princess May School, in which case the accepted tender showed a cost of £13. 18s. 4d. per head. This sum does not, however, include the cost of paving the playgrounds, erecting boundary walls, &c. It is possible to build for a considerably smaller sum per head in some localities. The school illustrated and described on page 352, built by the late Manchester School Board, containing halls for each department, the infants being in a separate block, was completed ready for occupation, including all drainage to site, making playground, caretaker's house, and all fittings, for barely over £9 a head; this must, however, be regarded as a somewhat exceptional case. The question of what an Elementary School should cost per head is naturally one of great importance to the Local Education Authorities, who have no ready means of determining whether plans submitted to them are economically arranged or not, except by taking them at the cost per unit. This amount must of course vary with the cost of building at the moment, and some table is required that would give the cost per head, given the cost of building per cubic ft. Again, in order to have a proper check upon the economy of the plan itself, it is useful to know roughly how many cubic ft. per head a well-planned building requires. If this amount is fixed approximately, it is easy to say at once whether any building has been planned without undue waste of space, and, given the cost of building in the locality, what it should cost per unit.

It is somewhat difficult to state definitely the number of cubic ft. per head that a building should contain, but a considerable number of examples of medium and large sized schools planned with the class-rooms opening off a central hall, with no space wasted in corridors, gave an average of about 400 cubic ft. per head, while the omission of the central hall would reduce this to about 350. It is of course possible to reduce this amount considerably, but any school that shows an allowance of much over 400 cubic ft. per head, even with a central hall, cannot be considered to be economically planned. This would mean that with building at 7d. a cubic ft. the school would cost £11. 13s. 4d. per head; at 8d., £13. 6s. 8d. As a school building can in most parts of the country be done for 7½d. or less per cubic ft., it is fairly correct to say that an Elementary School should not cost much more than £12 per head.

The following table of various Elementary Schools gives the figures of buildings actually erected :—

	No.	Accepted Estimate.	Per Head.
London School Board			
*Church Manor, Greenwich - -	1,548	£22,281	£14 8 0
*Wickham Lane, Greenwich - -	1,548	20,440	13 4 0
*Stanstead Road - - - - -	1,548	21,787	14 1 5
†Burslem School Board, Staffordshire -	660	8,200	12 10 0
†Hornsey School Board—The Campsbourne Schools - - - - - -	1,410	20,467	14 10 3
‡Gloucester Board Schools - - -	992	11,548	11 13 0
§Board School, Chesterfield - - -	1,236	15,000	12 2 8
Birmingham—Conway Road School -	1,040	18,000	17 6 2
‖Wales Board Schools—Glyn, Neath—Central hall, five class-rooms - -	320	3,479	10 17 6
Church Schools, Wolverhampton - -	850	6,000	7 1 2
¶ Tudor Road, Southall - - - - -	1,200	14,268	11 17 5
¶ Chase Side, Enfield - - - - -	1,160	18,518	15 19 2
¶ Wood Road, Willesden - - -	1,224	22,300	18 4 4
** Elementary School, Saffron Walden -	448	5,154	11 10 0

* *The Architect and Contract Reporter*, 3rd January 1902.

† In two blocks—(1) Hall 51 by 36 ft., and six class-rooms; (2) hall 45 by 28 ft., and four class-rooms. *The Builder*, 19th January 1900.

‡ *The Builder*, 28th September 1901.

§ There is included a pupil teachers' centre for 36, a swimming-bath 75 ft. long, a laundry and cookery centre, two halls 90 by 30 ft., and sixteen class-rooms. *The Builder*, 15th January 1901.

‖ *The Builder*, 20th July 1901.

¶ From figures supplied by the Architect, Mr G. E. T. Laurence.

** Figures supplied by Architect, Mr J. O. Smith.

In a report recently presented to the Sanitary Institute by Miss Alice Ravenhill there are some interesting figures given as to the cost of schools in America, from which it appears that a large City School of five storeys in New York can be built for 9½d. per cubic ft.

In "The Annual Report of the School House Department" of Boston for 1904 the question of cost is carefully considered, the price per cubic ft. being taken to be 11d. or 11½d. The question of cost is there reckoned from the point of the number of class-rooms rather than of pupils. The class-rooms are of a standard size, viz., 24 ft. by 30 ft. for Primary, and 26 ft. by 32 ft. for Grammar Schools, the height in each case being 13 ft. This gives at once the cubic contents of the teaching rooms. A careful examination of some well and economically planned buildings showed that the total area of any floor should not exceed double the area of the class-rooms on that floor. A further

comparison of a number of typical examples showed that a Primary School of twelve rooms or more, having neither assembly hall nor technical rooms, should never exceed 35,000 cubic ft. per class-room, and ought to be nearer 30,000 cubic ft.* A Grammar School, that is, a school taking children up to fourteen years of age, having an assembly hall and cooking and manual training rooms, should usually come out to 40,000 cubic ft., and should not exceed 45,000 cubic ft. In Chicago the cost of school building seems to be somewhat less; according to some figures furnished to *Das Schulhaus* in November 1904 by Messrs Patton & Miller, the Elementary Schools work out at 5½d. to 7d. a cubic ft., and High Schools at 7d. to 7½d.

Some recent inquiries in Germany† as to the cost of school building in different parts showed that there was a wide variation in the various States, from £10. 10s. a head in Breslau, to £20 a head in Cologne. The cost per class-room showed:—

Breslau	£540
Leipzig	600
Dresden	615
Berlin	750
Munich	935
Frankfort	1,045
Cologne	1,070
London—average of schools	700
Birmingham	1,000
Country School (no hall)	500
Manchester	600

Secondary Schools.

It is a matter of much more difficulty to find any general basis for calculation in the case of Secondary Schools, owing to the great diversity in arrangement, accommodation, and equipment provided, and the classes for which they cater. The result of this is that the cost per head will extend through a considerable range. It is possible by the exercise of the strictest economy, and by the elimination of everything but the barest essentials, to build a Secondary School for something between £25 and £30, while a quite satisfactory building,

* It is interesting to note that if the rooms were used for seventy-two at the rate of our Elementary Schools, viz., 10 sq. ft. of floor area, the cubic contents would come to about 400 cubic ft. per head as given above.

† *Das Schulhaus*, November 1904.

containing a central hall, studio, &c., can in most parts of the country be erected at a cost of from £45 to £50 a head. The cost of a Secondary School, however, very easily rises to £60 or £70 a head, as soon as the building aims at something more than mere utility.

A pupil teachers' centre recently erected in Marylebone by the late School Board, very much on the lines of that illustrated on page 190, but with the addition of a play-room in the basement, was estimated to cost £20,993.* The building, consisting of eight class-rooms, contains accommodation for 320, which brings the cost up to about £65 a head. This is high, considering that the class-rooms are arranged to take forty pupils. This pupil teachers' centre is, as far as the building is concerned, simply a Secondary Day School, and it is interesting to compare it with the plan of the Newcastle (Central) High School, illustrated on page 177, which has about the same accommodation, and cost about £9,000.

The new rules issued by the Board of Education for Secondary Schools set a more or less regular standard now to which these buildings have to conform. Roughly speaking, to build a school in conformity with them will cost from £45 to £50, according to the locality, but to do this requires careful and economical planning. As an example may be taken the High School for Girls at Stockton-on-Tees, now approaching completion; this building is in accordance with these rules and providing accommodation for 150 girls, cost under £7,000, or just over £46 per head, this sum including boundary walls and playground. In Fig. 142 is shown a school for 100 boys, which, including a residence for the Headmaster and boarding arrangements for 20 boys, cost only £5,629.

There are not of course very many buildings yet open that have been designed since the issue of these rules.

The High Schools in America, which are usually large and very elaborate buildings, very fully equipped, in many cases providing 20 sq. ft. of floor area per head, cost from £90 to £130 per pupil.

Boarding schools rise to a very large cost per head; in fact, anything from £200 to £600 a head may be required if many additional buildings are to be supplied, such as swimming-baths, gymnasium, &c., or large playing fields to be laid out.

A single boarding-house will, as a rule, be found to cost from £150 to £200 per head.

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* *The Architect*, 3rd January 1902.

The following table will give an approximate idea of the cost per head of the different types of schools, but is not intended as more than an indication.

Note.—These are based upon the supposition that the building can be carried out at about 7½d. per cubic ft.

Small Elementary Schools, with Halls or extra Rooms - - - - -	£7. 10s. to £10
Elementary Schools, with Halls, &c. -	£12 to £14
Higher Elementary Schools - -	£20
Secondary Schools and Pupil Teachers' Centres,	£30 to £40
Better Class Secondary Schools - -	£50 to £60
Boarding Houses - - - -	£150 to £200
Boarding Schools - - - -	£200 to £300
Training Colleges - - - -	£200 to £350

ON THE CARE OF SCHOOL BUILDINGS.

The actual care of the building and its supervision lie of course more immediately in the hands of the school-keeper, so that a few remarks upon his duties may not be out of place. The smooth working of the apparatus of the school and the comfort or the reverse of the inmates are to a large extent at the mercy of the school-keeper, who by ignorance or carelessness can completely upset the most carefully devised ventilating or warming apparatus. In the case of very large schools it is usual, and indeed necessary, to have a properly trained man in charge of the apparatus. In smaller schools this is not possible, but, given a man of ordinary intelligence. the mysteries of the heating apparatus can be soon mastered. It is worth noting that, unless a competent man be employed, it will probably be found that the extra expense caused by waste of fuel, injury to apparatus, and continual small repairs would make it cheaper in the long run to give a higher salary to obtain a better man. The school-keeper should be able to remedy small accidents himself, such as broken window-panes, &c., and have sufficient knowledge of gas and electric light fittings to be able to keep them in good order.

All the class-rooms, cloak-rooms, halls, &c., should be thoroughly swept daily, the woodwork and furniture being carefully dusted after such sweeping. All dusting and sweeping should be finished thirty minutes before the time fixed for the opening of the school. The floors of all corridors, class-rooms, halls, and other rooms should be thoroughly scrubbed when necessary. This is generally, in the case of Elementary Schools, considered to be about once in three weeks.

i.e., one department every week. In Secondary Schools it is not necessary that it should be done so often, and in Girls' Schools, where, as only indoor shoes are worn, the amount of dirt carried into the building is small, it is seldom required. As little water as possible should be used; sluicing the floors with water not only may cause damage to the ceilings below, but destroys the floor, and the dragging about of heavy desks upon it while wet tears the boards to pieces. Wood-block floors should be washed as seldom as possible. Wet sand sprinkled about and brushed off with a stiff broom is best for ordinary use. In Saxony the regulations require that the buildings should be scrubbed out at least four times a year, with a daily sweeping and dusting. Painted work, such as dadoes, &c., should be washed with soap and water during holidays. Polished floors require considerable attention for the first year, but after that need wonderfully little care to keep in good order. To maintain them in good condition the following treatment should be carried out about four times a year; for the first twelve months it should be done about once every four weeks. The floors should be swept and then rubbed over with methylated spirit and raw linseed oil (mixed in equal quantities) with a clean flannel; after this the polish is to be rubbed over the floor, which should be then brushed and finished with felt. The polish * should be thoroughly well rubbed into the wood until a smooth but not sticky surface is obtained.

Window Cleaning.—Windows should be cleaned on the outside at least three times annually; in towns where there is much smoke and fog, four or even five times will be necessary. On the inside the windows that are easily accessible may be cleaned whenever they seem to require it. When the sashes are taken out, care should be taken to see that the fastenings have been made quite secure when they are put back, as accidents sometimes occur from their slipping.

Drains, Traps, Gutters, &c.—All eaves and other gutters or

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* A good wax polish is as follows:

Yellow wax	20 parts.
Yellow ozocerite	20 parts.
Linseed oil (boiled)	1 part.
Turpentine	25 parts.
Raw sienna	5 parts.

Mix the two waxes over a slow fire, add the colouring previously mixed with the oil; when cold, add the turpentine.

lead flats should be cleaned before the commencement of each term, and care taken to see that the wire gratings over outlets or heads of pipes are in order, especially in the autumn, if there are trees near the building. The gullies should be thoroughly cleaned, all solid matter, sand, &c., that may have collected, being cleared out. In dry weather care should be taken to see that these traps are kept well charged with water to prevent any escape of gas. The disconnecting chamber should be occasionally examined and cleaned out.

The cisterns should be emptied and thoroughly cleaned during the vacations. The lavatories and all sanitary arrangements should of course be kept scrupulously clean. Where the basins are enclosed, the underneath parts should be cleared out once a week.

Care should be taken to see that trees and shrubs are not planted near buildings or walls, or tennis courts and paths paved with hard material. Creepers should as far as possible be kept to the plain surfaces of brick, and not trained round rain-water or other pipes, or over gratings, or upon roofs or gutters.

Heating.—Where open fires are used, they should be lit, if the weather is cold, at least two hours before the room is wanted for use. The openings of ventilating grates should be kept shut until the fire has been burning some time. Gas should under no circumstances be allowed for warming. In schools warmed by heating apparatus the school-keeper should of course attend strictly to the instructions given with the furnace. In frosty weather the fires should be kept alight night and day. It is a good plan to keep a small fire up during the winter vacation. The inlet valves for cold air should be shut at night during cold weather. Anything wrong should be attended to at once, as a large subsequent expenditure is often saved by prompt attention.

PART II.

BUILDINGS FOR ELEMENTARY EDUCATION.

PART II.—ELEMENTARY EDUCATION.

CHAPTER XV.

General Description—The Authorities dealing with Elementary Education—Their Powers and Duties—Different kinds of Schools under the Board of Education—Schools under the Home Office and the Local Government Board—Industrial Schools—Reformatories—Poor Law Schools—Regimental and Naval Schools—Meaning of Public Elementary Schools—Teachers, various Grades—Mixed Schools—Income available for Elementary Education.

THE elementary education in this country is under the control and general supervision of the Board of Education,* and is carried on in some 30,000 schools, consisting of the Public Elementary and Higher Elementary Schools; schools for children who are deaf, dumb, epileptic, or otherwise defective mentally or physically; buildings for special instruction, such as cookery and manual training, laundry work and domestic economy; and other schools or institutions which, though not receiving grants, are inspected by the Government and certified as efficient.†

The authority of the Board is due to its discretionary powers in awarding or withholding the Government money, since every school, in order to earn its annual grant, has to be carried on in accordance with the "Code of Regulations" issued yearly by the Board of Education, subject to such inspection by His Majesty's Inspectors as the Board may think fit, and further, to satisfy the requirements of the Board with regard to its buildings, equipment, and the number of children accommodated.

The actual work of administering the work of education is entrusted

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* For the constitution and powers of the Board of Education, see *ante*, p. 13.

† The advantage to a private school of being inspected and certified as efficient lies in the fact that the children attending are considered to be undergoing suitable instruction in accordance with the law as to compulsory attendance at school.

to the bodies created by the Act of 1902,* and known as the Local Education Authorities. The Act provides that School Boards and School Attendance Committees shall be abolished. Their powers and duties are taken over by the County Councils, the County Borough Councils, the Councils of non-county Boroughs with a population of over 10,000, and the Councils of Urban Districts with a population of over 20,000; each of these, as far as elementary education is concerned, becomes the Local Education Authority for its own area. The constitution and powers of these Authorities has been already described generally.† Their special duties with regard to elementary education may be stated here.

They have had to take over all the duties and obligations of the late School Boards, but in addition to this they are responsible for the secular education in all the Public Elementary Schools in their district, and are bound to maintain and keep efficient all the Public Elementary Schools which are necessary, and to control all expenditure, except of course that for which managers of Voluntary Schools are themselves responsible, such as structural improvements, &c. This puts the Voluntary Schools upon the same footing as the old School Board schools as regards current expenses of maintenance. The two kinds of schools are described in the Act as "Schools not provided by the Local Authority," and "Schools provided by the Local Authority;" they are now usually known as "Non-provided" or "Voluntary Schools," and "Provided" or "Council Schools." The main difference between the two lies in the different method of appointing managers; the fact that in the Voluntary Schools denominational religious teaching may, subject to the conscience clause, be given; and that in these schools the cost of all repairs and necessary alterations (except those due to fair wear and tear caused by its use as a school) must be met by the managers. The further points affecting the duties and powers of the managers of the two kinds of schools can be seen by a reference to the Act, which is printed in full in the Appendix.

In addition to the schools that are under the control of the Board of Education there are a certain number of institutions giving elementary education that come under the jurisdiction of the Home Office and the Local Government Board.

The Home Office comes in contact with elementary education as the Authority dealing with penal organisation, and consequently is con-

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* See p. 13.

† For full text, see Appendix, p. 514 *et seq.*

cerned with the children sent to the Reformatories and Industrial Schools; it plays, again, an important part by its power of regulating the hours and conditions of children employed in factories and mines.

Reformatories are schools to which are sent children up to the age of sixteen who have been convicted of an offence punishable with penal servitude or imprisonment, and such children must not have served a previous time in prison.

Industrial Schools are for children up to the age of fourteen who may not have actually committed an offence, but who, if left in their circumstances and surroundings, are likely to become criminal; that is to say, the Reformatory Schools are for actual, the Industrial Schools for potential delinquents, the children in the former being on an average three years older than those in the latter. To these schools also may be sent children who are incorrigible truants, or those who are beyond the control of their parents.

Day Industrial Schools were a further development of the Industrial School Act of 1876. These are schools to which can be sent children of parents who habitually and without reasonable excuse neglect to provide for their proper education, or those children who will not go to school even when sent by their parents. At these schools the children are compelled to attend daily, the school being simply an ordinary Elementary School, with rather a greater attention paid to industrial training. In case of non-attendance the absentee is at once sent for. There are only about twenty of these schools at present in operation, but the marked success of the system is such that an increase in the number is probable.

Under the Local Government Board come the Poor Law Schools, to which pauper children are sent by the Guardians. Large numbers of such children, either from the workhouse or when boarded out, or of parents in receipt of outdoor relief, attend the Public Elementary Schools. A certain number of Poor Law Unions in London and large centres of population have established large Boarding Schools for pauper children known as "District" or "Poor Law Schools," situated as a rule in the country outside and often at a considerable distance from the area covered by the Union.*

The Regimental Schools come under the control of the Commander-in-Chief, and in them are taught the children of the soldiers, and also any men that are particularly backward.

Similarly, there are the Naval Schools under the Lords of the

* A large amount of valuable information in regard to such schools will be found in "Children under the Poor Law," Sir W. Chance, Bart., 1897.

Admiralty, and there are also seven home training ships with some 2,500 boys, the education on which comes up to about Standard VI. of the requirements of the Board of Education, with an advanced class for algebra, trigonometry, and navigation.

A sum of money is granted annually by Parliament for public education in England and Wales, the object of which grant is to aid in maintaining the Public Elementary Schools and the Training Colleges for Teachers.

An Elementary School for this purpose means a school or department of a school at which elementary education is the principal part of the education given, and one at which the ordinary payments for instruction do not exceed ninepence a week.

The name Public Elementary School implies that the children shall be perfectly free in regard to religious instruction, being at liberty to be away from school if there is any day specially set apart for religious observance by the body to which their parents belong; the religious instruction being placed at the beginning or end of the day's work, so that any children whose parents so desire it can be withdrawn from such instruction without detriment to their other work. The school must also be open at all times to the inspection of any Government Inspector.

The age at which attendance is reckoned for the purpose of the grant is above three years and below fourteen. Attendance is not, however, compulsory before the age of five years.

The actual control and management of the school is in the hands of the Local Education Authorities as described above, who are directly responsible to the Board of Education for the adequate support, efficient management, and the supply of necessary schools within their area. They have a large freedom as regards delegation of powers, and except that of raising money may depute any or all of their powers to suitable committees, and through them to bodies of managers for single schools or groups of schools, appointing to the case of schools not provided by themselves one-third of the managers.

The number of the teachers is intimately connected with that of the plan of the school building. It is laid down in the Code, that, in considering the sufficiency and suitability of the staff, the Board will, among other points, take into consideration the arrangement of the premises. A badly arranged school, with the class-rooms of an inconvenient size, either means an unnecessary excess of teaching power if the class-rooms are too small to be capable of holding a class of the full size for which one teacher is recognised, or, on the other hand, and perhaps

more commonly, making it necessary to have a class far too large for one teacher if the building is to hold the full complement of children for whom it is supposed to have accommodation.

It is important that an architect who has to do with Elementary Schools should have a clear idea of the different classes of teachers, and the number of children for which they are severally recognised by the Board of Education.

The subject of teachers in the Elementary Schools is rather a complicated one, owing to the various plans by which older pupils and teachers in training known as pupil teachers assist in the regular teaching work of the school while themselves still undergoing instruction. There have been a large number of forms of organisation tried in the Elementary Schools of this country, from the system of Bell and Lancaster, in which one duly qualified teacher was considered able to manage a school of 1,000, assisted only by monitors and elder pupils, but little removed either in age or attainments from the children they were supposed to be teaching, up to the complete class-room system where each form not only has a class-room to itself, but a duly certified teacher in charge, as in the German Schools. These different schemes of organisation are treated in more detail when considering the best form of building adapted to them.

The general tendency now is in the direction of employing only fully qualified teachers, with a separate class-room for every class, pupil teachers being regarded more from the point of view of the training that they are getting in the art of teaching than as an actually useful part of the staff.

The various teachers and the number for which they are supposed to count is as follows :—

	Average Attendance.
The Head Teacher - - - - -	50
Each Certificated Assistant Teacher - - -	60
Each Assistant Teacher—uncertificated or provisionally certificated - - - - -	45
Each Supplementary Teacher - - - -	30
Each Provisional Assistant Teacher - - -	30
Each Pupil Teacher - - - - -	30
Each Probationer - - - - -	20

The schools are divided into (1) the Infant School; (2) the school for older scholars. This may be again divided into separate departments for boys and girls, or the two sexes may be taught together, in which case the school is known as a "Mixed School." When a Mixed School is large it is not uncommon to find it divided into a Junior and

Senior mixed, or sometimes it is found convenient if a school is so large as to make these two departments unwieldly, to have a school of four departments, as—Infants, Junior mixed, Senior boys, Senior girls, or the Juniors may be separated with a mixed Senior department. It is of course necessary for an architect, if he is to make a satisfactory plan, to understand clearly at the outset the method of organisation that is proposed, in order to provide the requisite entrances, cloak-rooms, as well as the arrangement of the hall.

The school above the Infant Department is divided into seven standards, each standard having a carefully defined limit of attainment on a scale fixed by the Education Department.

There is usually in the larger schools a standard above the seven regular divisions known as the ex-seventh, in which the work done may be much the same as a Higher Grade School—that is, carrying on and completing the elementary education of a boy who is willing to stay at school for a year or two beyond the time of actual compulsory attendance. Promotion from one standard to another is made by the head teacher, but no pupil is held to have passed any particular standard for the purpose of exemption from school except upon a special examination by the Inspector.

The law of attendance at present in force as to attendance at school is as follows:—Every child between the ages of five and fourteen must attend regularly * some certified efficient school, unless he is being properly instructed in some other way to the satisfaction of the Authorities. In the case of deaf and dumb children, or those mentally defective, the age of compulsory attendance at school is increased to sixteen years with no form of exemption.

Children attending schools at which the fees for instruction are more than ninepence a week do not come within the range of the law as to attendance, as such schools are supposed to lie outside the sphere of School Attendance Acts.

The School Attendance Act of 1899 raised the minimum age of exemption to twelve years, at the same time raising the standard required to obtain exemption, so that now no child may leave school before the age of fourteen, unless being over twelve years old they have passed the seventh standard at a special examination by the Inspector. This makes it difficult for any one to get away from school much before the age of fourteen. At the same time, the old system of granting half-time on passing certain standards at the required age has been totally done away with.

* *i.e.*, ten times a week, whenever the school is open.

Arrangements to ensure regularity of attendance at school are made by the School Boards for their own districts; the final resort being to summon the parents in the Police Court, or before two Justices of the Peace at Petty Sessions, the maximum penalty being 20s., or imprisonment in case of default of payment.

The income necessary for carrying on the schools is provided by—

(1.) The Government Grants:—

- (*a*) Education Grant for Day Schools.
- (*b*) Grants for Schools for the Blind, Deaf, and Defective Children.
- (*c*) Education Grant for Evening Schools.
- (*d*) Fee Grant.
- (*e*) Grants from the Home Office for Industrial Schools.

(2.) The Education Rate.

(3.) Pupils' Fees.

(4.) Voluntary Subscriptions: these are now only required as far as may be necessary to build new or add structurally to existing non-provided schools.

Having thus briefly reviewed the conditions under which the elementary education of the country is carried on, we can now pass to the buildings. These, in order that the schools may earn a grant from the Government, have to be erected, or, as far as may be required, altered, to the satisfaction of the Board of Education. In order that intending builders and their architects may know their requirements, the Board issue a list of Regulations,* giving with considerable detail the minimum that is considered necessary in the building and equipping of new schools, but wide latitude is left as to the actual planning and arrangement of the buildings.

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* See Appendix A, where the Regulations are printed in full.

CHAPTER XVI.

DEVELOPMENT OF THE MODERN TYPE OF ELEMENTARY SCHOOL.

Short Description of the various Elementary School Systems, leading up to their present Organisation—The Bell and Lancaster System—Stow's System—Wesleyan Schools—Pupil Teacher System—The "Prussian" or Class-room System—The "Ben Jonson" School—Criticisms on, at the time—Adoption of the Central Hall System—The Development of the Modern Type of Elementary School Building.

BEFORE passing on to the consideration of the modern type of Elementary School, it may be of interest to state shortly the various steps which have led to the adoption of the present form of building and system of teaching. And as so many of the schools now in use owe their form and arrangement to some system of teaching that held sway for some time to be replaced by another, it will be necessary to consider briefly the more important of those methods which have left their mark in the buildings.

It was at the end of the eighteenth century that Joseph Lancaster started his schools on somewhat similar lines to those which had already been put on foot by Dr Bell, who, when in India, had been much impressed with the value of mutual instruction, that is to say, the instruction which pupils receive from their fellow-pupils; his idea being that one who has just learned a certain thing himself will know the difficulties better, and be more clearly able to explain them to another, and present them in a form more easily intelligible to the learner from having so recently conquered them himself. The school was worked in this manner:—The master or superintendent conducted the entire school through the agency of the scholars themselves; the school was divided into small classes of equal proficiency; the children were sometimes paired off, an inferior being taught by a superior boy; to each class was attached one, or, if the class was large, two teachers, themselves boys but little removed in age from the class they taught. The master of the school taught his monitors

and class teachers out of school, doing little or no actual teaching during school hours, which indeed he could have had but little time for, as one master would have to manage a school of perhaps a thousand, his time being taken up with supervision, and in stimulating the work going on. The arrangement of the school building was simple. It consisted of one large oblong-shaped schoolroom (see Fig. 274), with windows 6 ft. from the floor, the floor being slightly inclined upwards from the master's desk to the farthest end of the room, where the highest class was placed. The master's desk was on a platform 2 or 3 ft. high. Fixed forms and desks occupied the middle of the room, a passage of 5 or 6 ft. being left between the ends of the forms and the walls, in which space the children formed semicircles for reading.

The advantages and disadvantages of the system are thus summed up by Mr J. H. Cowham.* It was cheap, and brought some form of education within the reach of all; the numerous classes allowed a rapid promotion of clever children; all were working under direction instead of being left to themselves as in the old system, and, provided there was a good supply of superior children, it worked well as far as regards the young children. At the same time the teaching was mechanical and uninspiring. In order to provide some incentive to work, it was necessary to have a very elaborate system of rewards and punishments. While all in the school received some education, few became really efficient. Finally, there was a natural objection on the part of the parents either to their children spending all their time teaching, or to their being taught by their schoolfellows. Bell and Lancaster themselves, however, regarded their schemes with extraordinary enthusiasm, looking upon themselves almost as prophets, and foreseeing the day when this system should be in use throughout the world.† It soon, however, became apparent that although the monitorial system had some advantages, the greatest perhaps being that of cheapness, the results of the system could not be considered satisfactory. It was pointed out by Stow, who instituted the form of school known as the Glasgow or Training School in 1826, that while monitors may be able to teach facts which they have learned according to the rote system, such as the sounds and names of the letters or words, they cannot work the

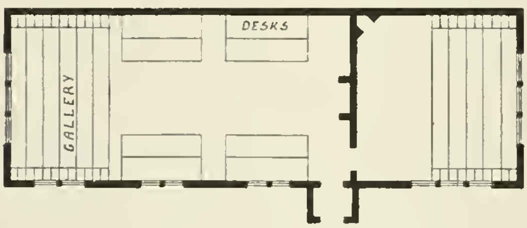
274. A Lancasterian School.

* School Organisation. 1896.

† Educational Aims and Methods, Sir J. Fitch.

facts into the minds of their classes, they do not possess the requisite authority, nor can they give any moral training. The main idea of Stow's system was:—The employment of skilled teachers whose influence over the children should be direct and continuous; they were to be with the children in the playground, or, as he called it, the uncovered schoolroom, and incidents observed there were used as illustrations or examples for the purpose of moral training.

In teaching, the main object was to induce the children to think and acquire knowledge for themselves instead of being told. Great pains were taken by fitting up the playground with apparatus and by systematic drill to ensure the physical development of the children. It was his condemnation of the system of monitors and demand for skilled and trained teachers which led the way to the pupil teacher system, which was then devised in order to provide proper training of skilled teachers, and a means whereby they could be obtained. A school planned on Stow's system was arranged as follows (see Fig. 275):—At one end of the large schoolroom was a gallery. Owing to the necessity of complete supervision, Stow regarded this as indispensable. This gallery was large enough to accommodate at least two-thirds of the school. There was an open floor space having about twice the area of the gallery. There were two long desks at each side of the door to accommodate the children who could be drafted off there for writing, and at the opposite end of the schoolroom to the gallery were one or two class-rooms, each of which also had a gallery.

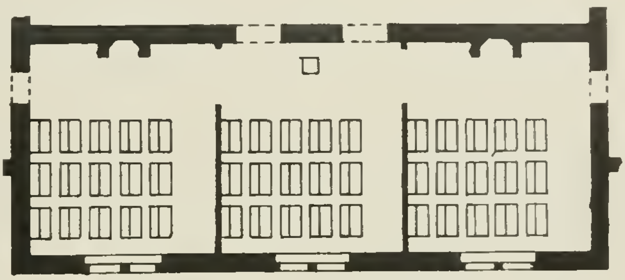


275. A School on Stow's System.

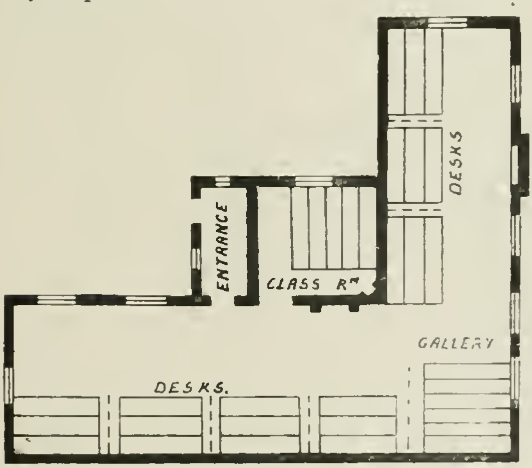
These arrangements were usually adhered to, although of course various modifications were made. The schools were graded with Senior, Junior, and Infant Departments, boys and girls being taught together. The Wesleyan Schools were usually arranged on this plan, with gallery of proportionately much greater size, but these schools were built quite as much with a view to their use as Sunday Schools as for ordinary work. For the satisfactory working of this plan a large number of pupils were required in order to allow of proper grading.

The pupil teacher system as now in vogue is a development of the preceding system. It accepts from the monitorial system the plan

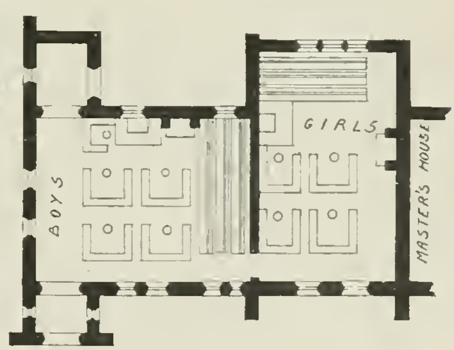
of taking the pupil teacher from the ranks of his fellow-pupils, but there the resemblance ends. The pupil teacher is not allowed to teach until the age of fifteen, and then only after a certain examination has been passed. The pupil teacher is paid for his or her services, and is probably preparing for a teaching career, learning the art of teaching as a means of livelihood, instead of, as in the old Lancasterian system, merely undertaking it as a temporary and unpaid employment. In schools arranged on the pupil teacher system it is usual to find long narrow class-rooms in which blocks of desks can be either screened by curtain or other forms of partition, or left open (see Figs. 276, 277), so that the master can effectually supervise all the work going on. It was a very common plan to



276. A Schoolroom on the Pupil Teacher System.



277. School Arranged on the Pupil Teacher System. Classes divided by curtains.

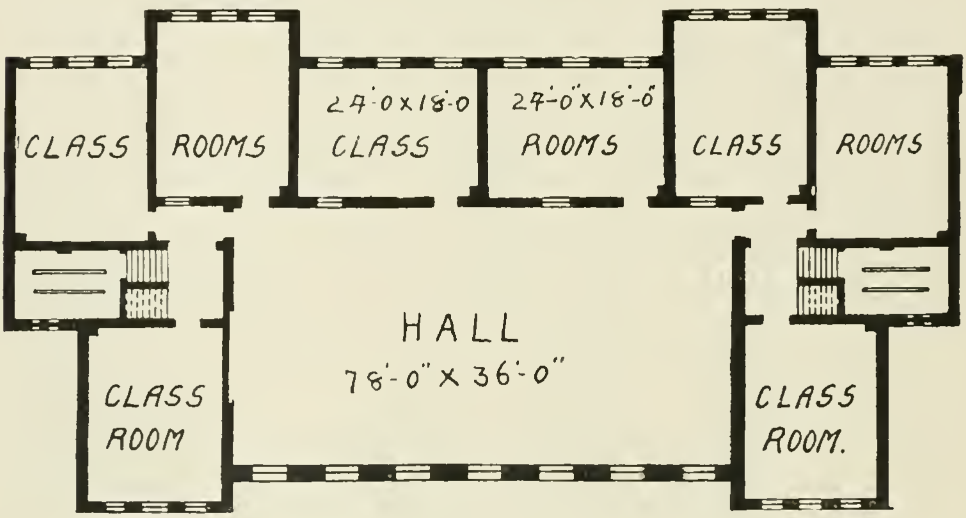


278. A Village School about 1840.

have an L-shaped room, with perhaps a class-room containing a gallery at one end. The school then would be arranged somewhat on the lines of Fig. 277. Fig. 278 * shows a plan of a Country School in the

* From Designs for Schools. H. E. Kendall. 1847.

early part of last century, arranged for one master assisted by pupil teachers who would take their forms in small groups. But even as late as 1870 school building had not got beyond the point of a large schoolroom, divided sometimes with curtains, and with one or perhaps two class-rooms. In 1871 * the London School Board determined to obtain information about the Prussian plan of school building, and to see whether such a system would be applicable to London. Finally, after much argument, and apparently with considerable misgivings, the Board determined to build a school on the following conditions:— That the two departments above the Infant School, viz., the older boys and girls, should be divided into classes of not more than 80 each, and that a separate teacher for each class should be provided, the



279. THE BEN JONSON SCHOOL. Built in 1872.
T. Roger Smith, Architect.

general schoolroom (centre hall) being available for one class. The accommodation to be provided for the school was very greatly in advance of any previous building. One of the class-rooms was to have a top light, so that it should be available for drawing. Further, each department was to have proper accommodation for the teaching staff.

There was a competition in which twelve architects took part. The design sent in by the late Professor T. Roger Smith was judged to be the best, and the result was the school now known as the "Ben Jonson" School in Stepney. This is a most interesting school, especially in view of its date.

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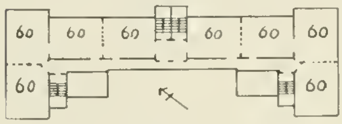
* T. H. Spalding, The Work of the London School Board, pp. 63 to 68.

On looking at the plan of this school (Fig. 279) it will be at once seen what a very great advance it was on any previous building, the general scheme of the plan being very closely on the lines of the type of school now usually built by the London School Board, *i.e.*, with all the class-rooms opening off a central hall. The rooms are in nearly all cases lit from the left side, two being lit from the back only. The lighting would, however, hardly be considered sufficient when judged by modern standards, but the whole arrangement of the building is admirable. The system of arranging for the accommodation of the teachers on mezzanine floors—a plan now usually adopted—is here found for the first time. Curiously enough, this school found so little favour at the time it was erected that it was considered to be a failure, and no similar buildings were erected for a considerable time. Mr Robson in his book on School Architecture in 1874 came to the conclusion that the plan of this building was unsuitable for an Elementary School chiefly on the ground of its great size, saying that the gathering of a large aggregation of children into one building was condemned by the experience of all Europe; secondly, on the comparative uselessness of the hall; * and thirdly, on the great expense involved in such a system of class division. These objections have not been supported by subsequent experience, nor is it, at all events at the present day, the fact that the feeling of Europe is against large schools. In Germany, for example, it is quite common to find schools of 2,000 or more. It is curious to note that this school, though condemned as a failure in 1873, is practically the prototype of the modern Board School, and that, although one of the strongest objections to it at the time was its great size, it has been twice added to since.

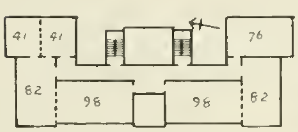
The School Board having decided that their experiment was not a success, gave up the idea for the time of having separate rooms for each class as a general rule, and proceeded further to elaborate the pupil teacher system. This required a building with long narrow rooms in which a number of classes could be placed; a type of plan which is peculiar to this country (see above, Figs. 254, 255). After this time the influence of the German system of school planning can be very strongly traced, and, as the hall or large schoolroom not used for regular teaching had been settled to be a great waste of space, a very large number of schools were erected on the principle of the

* It is only right to note that Mr Robson, when writing on the subject some years later, expresses the opinion that the central hall is indispensable, and gives the best form of plan for a school. "The Planning of Schools," *The Builder*, February 1888.

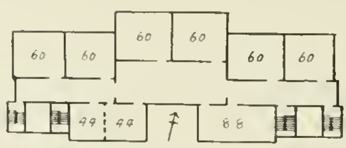
corridor with rooms opening off it (see Fig. 280). The schools about this date show a curious medley of plans, being apparently to a large extent attempts to combine the English and German types. See Fig. 281, which shows the reversion from the "Ben Jonson" type of school to that of the large class-room taking 80 to 100 children. However, the tendency in all the various forms which the schools took at this time was in the direction of increasing the number of class-rooms and in widening the corridor, which was evidently found very useful in the discipline of the school for forming up the children at dismissal, &c. Fig. 282 shows a school in which the corridor has become of considerable width, and nothing but a small increase in size is required, as in Fig. 283, built a few years later, for the corridor to become a hall. This school, built in 1882, is practically a reversion to



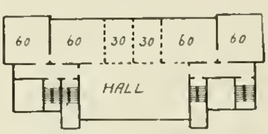
280. CRANBROOK ROAD.



281. YORK ROAD.
1874.

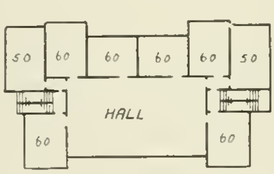


282. GLOUCESTER ROAD.
1875.

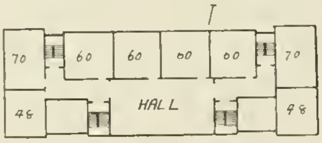


283. MINA ROAD.
1882.

the "Ben Jonson" type of plan, and, with a few minor alterations, has continued as the form in which the London Board Schools are built to the present time (see Figs. 284, 285). It was not, however, adopted for all schools immediately, and many schools were still built of various forms; but after this year, 1882, the hall or large schoolroom always



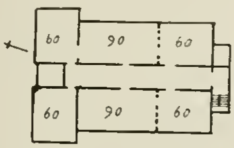
284. THE BEN JONSON SCHOOL.
1872.



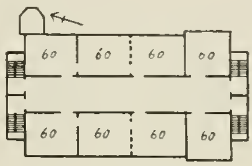
285. CULLODEN STREET SCHOOL.
A Modern Board School. 1900.

appears, whatever type of plan is used, provided of course that the site will allow room for it. The series Figs. 286-288 show another form of plan—a corridor with class-rooms opening off it, also commonly found in German Schools. This again naturally widens into a hall. The form in Fig. 288 is that which was adopted ten years later for the Hugh

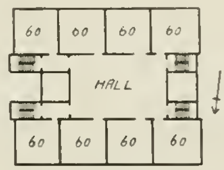
Myddleton School (Fig. 289). It is interesting to compare Fig. 287 with a recently erected school in Manchester, which is merely the same idea on a larger scale. Fig. 290 shows another way in which a hall with class-rooms opening off it on all four sides would arise, for in the



286. Compton Street. 1881.

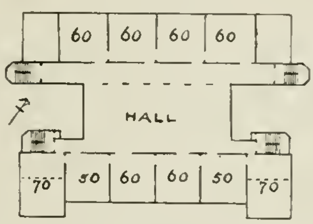


287. Bath Street. 1881.

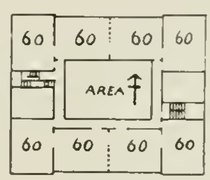


288. St John's Road. 1883.

case of a school (as Fig. 290) built round an area it merely requires covering in to form a central hall, as in Fig. 288. The form of school arrived at in 1882, and practically adopted for the London Schools during the next few years, has remained in vogue since that time with practically no alteration except in the direction of better lighting, small



289. The Hugh Myddleton. 1893.



290. Haggerston Road. 1879.

improvements in detail, and more careful graduation in the size of classes; and for schools organised as the London Elementary Schools are it is not easy to see in which direction improvements are to be looked for, as far as the general scheme of the building is concerned.

, The above diagram plans are taken from the Report of the School Management Committee of the London School Board.

Chapter XVII.

ELEMENTARY SCHOOL BUILDINGS.

General Considerations—New Schools—Comparative Advantages of Large and Medium-sized Schools—Difference in Expense—Number of Class-rooms required—Variation required in the Size of Class-rooms—Mixed Schools—Proportion of Infants to Older Scholars—Number of Storeys—Area necessary for Sites and Playgrounds—Figures of German School Sites—Arrangement of Building on the Site—Examples—Covered Playsheds—The Hall or Assembly-room—Position of, in reference to Class-rooms—Cloak-rooms—Teachers' Rooms.

It is proposed to follow the method adopted in the case of the Secondary Schools, that is, to consider first certain points that apply to Elementary Schools generally, and, after having described in detail the various parts and rooms that go to make up the school, to pass on to the question of the planning of the different types of building. It is easier in this way to consider the plans entirely from the point of view of arrangement, by avoiding digressions upon the purpose and arrangement of particular rooms.

When the need for a new school arises, the first question to be settled is that of the number for which the new building will have to provide. There are various methods by which the likely number of children of school age can be predicted with more or less accuracy. Generally speaking, a fairly safe guide is to take one-sixth of the whole population of the district that the school is to serve, and subtracting from this number one-seventh for children of a class above that attending the ordinary Elementary School, more or less according to the nature of the locality. Naturally, the rate of probable increase in the district is an important factor.

Size of the School.—In very crowded districts, when the population supplying the children for the Elementary Schools live very close together, it may happen that one school, unless of a very great size, will be insufficient to supply the want of school places. The question then arises as to what should be considered the maximum

number of children in one school, a point upon which there is considerable diversity of opinion.

On the Continent little objection seems to be felt to the collection of very large numbers of children in one building, should it happen to be situated in a thickly populated district. (Apart from the question of increased chances of infection, there is probably less objection in the case of a school organised on the German system, where each class has a tendency to be a little school in itself.) In this country, however, there has been a growing feeling that these large schools are not altogether satisfactory. Although departments of five and six hundred or more show excellent educational result, and are undoubtedly a great economy both in initial cost and maintenance, yet there is, it is asserted, a tendency to routine and discipline almost military, the Headmaster can have little personal knowledge of so great a number of children, and so, by treating them in masses rather than as individuals, cannot exercise upon them that personal influence upon which the real success of a school ultimately depends.

So strongly has this been felt that the Board of Education laid down in a recent issue of their rules for building the desirable number of children in a department under one head teacher to be 360, and that under no circumstances ought the number to exceed 400.

This practically limits the size of a school of three departments to something between 1,080 and 1,200, though the number can of course be increased by adding a fourth department. Naturally, this policy of limitation in the size of schools is one that is popular with the teaching profession, as the number of head places is thereby increased, with the drawback, however, that there is a corresponding diminution in the number of the more important posts.

It should be noted that this limitation is rather in the nature of a suggestion than an absolute requirement, so that any cases in which a large department seemed particularly desirable would no doubt be considered on their merits.

It is one of the objections brought against the limitation to size of a department that it runs counter to a form of school organisation, that has many strong advocates, consisting of a mixed department of 700 or 800 to 1,000, having a head teacher aided by one or more principal assistant teachers.

The late School Board for London came to the conclusion that 1,548, in three equal departments of 516, was the most satisfactory size for a large school.

There is probably little doubt of the increased educational

efficiency of the rather smaller school, but to build for 1,000 instead of 1,500 means five buildings in the place of three, and represents an increase of expenditure, in sites, building, and maintenance, of something like 15 per cent.

As far as the question is affected by purely architectural considerations, there is something to be said for the medium-sized school; the possibility of making all the class-rooms open off a central hall is hardly feasible for more than seven or eight separate rooms, unless the hall be made of an unnecessarily large size. The extra class-rooms have to be arranged opening off a corridor at each end of the hall, and this causes some loss of easy supervision. But this objection is not a strong one, and from the point of view of buildings alone there is little to be said against the large school.

Number of Class-rooms required.—This is a question that is apt to receive much less consideration than it deserves. It is still quite common to see schools erected in which all the class-rooms are of one size, generally to take 60 pupils, while the working number for the school is taken as the sum of the class-rooms. As a matter of fact, of course, the classes differ considerably in size, and if the lower standards are up to 60 those at the top of the school will be between 40 and 50. The result of making the rooms all of one size either entails waste of accommodation, or, if the master is forced to fill his school up to the full number of seats available, results in unsatisfactory grading. This difficulty, considerable in the case of a large school, becomes still more marked in smaller buildings arranged, say, with three class-rooms for 60, to provide for 180 children. There are probably the usual seven standards to be provided for, and the problem how to arrange them in three lots of 60 becomes a serious difficulty. As a matter of practical teaching they would probably be divided into four or five groups, and a suitable building to hold them would have a long room or schoolroom in which several classes could be taught, with two class-rooms for, say, 36 and 50.

It is still not uncommon in the older schools to find class-rooms capable of holding 70 or 80 scholars, but it is now recognised that a teacher cannot adequately deal with a greater number than 60, and the Board of Education do not recognise a class-room in a new school for a larger number than that. A class of 60 is considered by many to be too large, and in many of the better new schools there are no class-rooms built for more than 50, while considerable provision is made for classes of 40.

The late School Board for London devoted considerable attention

to the most suitable and economical method of grading their class-rooms, coming to the conclusion that a department of 516, which they regarded as a suitable standard size, should have one class for 60, four for 56, four for 48, and one for 40.

The fact that there are seven standards in an ordinary Elementary School should be carefully borne in mind by an architect in order that adequate provision may be made.

One result of the recent opinion of the Board of Education as to a suitable size for a department being 360, coupled with the rule that no class may exceed 60, has been the production of schools with six class-rooms for 60, an arrangement that does not form a convenient school. There should be for about 360 children at least seven class-rooms, which might conveniently be graded as follows:—

$$\left.\begin{array}{l} 2 \text{ for } 40 \\ 2 \;\;,,\;\; 50 \\ 3 \;\;,,\;\; 60 \end{array}\right\} 360, \quad \text{or} \quad \left.\begin{array}{l} 1 \text{ for } 40 \\ 2 \;\;,,\;\; 50 \\ 2 \;\;,,\;\; 56 \\ 2 \;\;,,\;\; 60 \end{array}\right\} 372.$$

The requirements of a particular locality and arrangement of schools in the district may render some quite different proportions desirable, but the necessity of providing a class-room for each standard as soon as the numbers are near 300 should be remembered.

Mixed Schools.—The plan of the school will depend of course to a large extent upon whether the school is a "mixed," *i.e.*, both sexes taught together, or whether it is organised in two separate departments for boys and girls.

Mixed schools are often divided into Senior mixed and Junior mixed, the two departments being separated either on different floors or in separate parts of the building. In such cases it will be necessary to supply four sets of entrances and cloak-rooms, as each department must have separate entrances for the sexes.

The hall is either arranged for each department, or, as is often done, one large hall serves for the entire school, as for example in Fig. 339.

In large schools where there are sufficient numbers to secure proper grading, as far as ease of organisation and economy in building and staff are concerned, there is little difference between mixed or separate departments, but in the case of small schools the combination of the two departments of the upper school certainly adds very considerably both to the efficiency of the work and economy in cost and maintenance.

The educational aspects of teaching the two sexes together hardly concern us here. Head Teachers of mixed schools generally speak highly of the plan. It is universal in America, about evenly divided in this country, London rather favouring separate departments. In Germany, except in schools so small as to have only one room, the sexes are not taught together.

Proportion of Infants to Older Scholars.—The relative proportion between the Infant Department and the Senior School is variously laid down by different writers. Mr Robson * suggests that of 1,040 children there would be 400 in the Infant Department and 320 in the Boys' and Girls' respectively. The common system is to make the three departments equal, for while the Infant School combines both girls and boys, and so apparently should be much larger, yet, as the time spent in the Infant School is just about half that spent in the older school, the numbers should be equalised. But it should be remembered that, if the school is situated in a poor quarter, a large number of parents will send their children to school at three, the earliest age allowed, in order to be relieved of them, while they themselves go out to work. In fact, in many schools there is a special room † called the babies' room, which is practically a crêche for the convenience of the parents, which, while doubtless of considerable advantage to them, is at least open to argument as a function of an educational body dependent upon the rates and State aid.

In the conditions given for a competition for an Elementary School recently built at Manchester, the numbers being 2,000, the proportion of infants was estimated at one quarter. A school at Birmingham recently erected for 1,000 has accommodation for 470 infants, but in this case (see Fig. 292) there are two class-rooms dividing the upper school from the Infant Department which are used in a way as a transition form, and can serve either for the older school or the Infant Department as may be desirable. On the whole, the plan of estimating the number of the Infant School at half the other two combined seems the most reasonable.

Number of Storeys.—There is no doubt that the less the number of storeys in a school building the better; but exigencies of site and the effort to supply good playgrounds make it essential that schools erected in London and other large towns should take up as little room as possible. Hence the usual type of building in central

* School Architecture, p. 164. † See below, Infant Schools, p. 322.

London, which consists of three storeys corresponding to the three departments. In the country towns, where it has been possible to secure large sites, it is not uncommon to find buildings with all the accommodation on the ground ; and there is little doubt that where this can be done the result is very satisfactory. Where there is no pressure on the available space, it is usual to find the Infant School in a separate one-storeyed building, either standing adjacent to the school for older scholars or connected with it.

The questions of site and aspect considered in Chapter II., in regard to Secondary Schools, are of course equally applicable to Elementary Schools, and need not be repeated here.

Area necessary for Sites and Playground. — The area provided for the playground is naturally governed to a large extent by the position of the school and the financial resources available. The minimum amount of superficial area is laid down by the regulations of the Board of Education as 30 sq. ft. per head. It is by no means always easy, in the case of a school built in or near the busy part of a town, to secure as much as this, but no effort should be spared to provide as large a playground as possible. As Mr Bailey, the architect for Education to the L.C.C., speaking of restricted sites, says :— "As, whatever the difficulty, sufficient space to ensure light and air *must* be obtained, the playground question is usually best solved by providing on the ground level for the boys and infants, and putting a flat over the whole top of the building to form a playground for the girls, which should not be enclosed entirely by a wall, but should have either panels filled with iron grills or some lengths of railing, as otherwise the natural curiosity of the child to see what is beyond might lead to unpleasant, not to say dangerous, consequences. Such playgrounds do not give more than 10 or 12 sq. ft. to each child, however." *

The building regulations of the Board of Education require not less than $\frac{1}{4}$ acre for every 250 children. This will, except in the case of a very small school, give a fairly satisfactory result, but it ought to be regarded as a minimum ; and in the case of a large school for 1,200 in three departments, or 1,600 in four, a site of not less than 2 to 3 acres should be secured. This will allow of one-storeyed buildings placed, if considered desirable in separate blocks for the different departments,

* The Planning and Construction of Board Schools. Paper read to the R.I.B.A., May 1899.

and also will leave room for additional buildings for manual training, laundry work, &c.

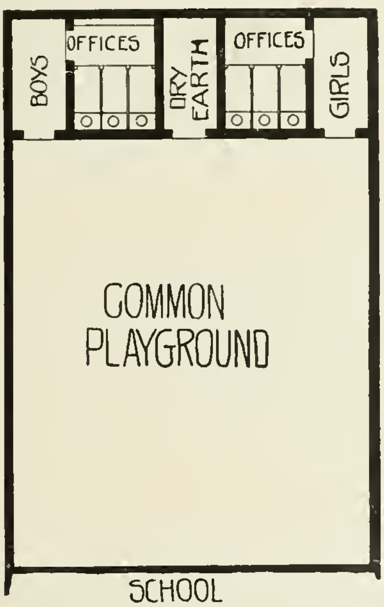
It is of course a great economy to buy a site large enough for subsequent increase, and also to ensure light and air in any place where buildings are likely in future to be brought up to the boundary, as the resulting increase of population will require additional school accommodation, while the land required for adding to the school and playground will become unobtainable.

In Germany the sites are, as a rule, smaller than those in this country. Much space is also taken up by various buildings—a gymnasium, caretaker's and Headmaster's houses, a garden with carefully laid-out beds and grass plots—so that the space left for actual playground is in the end very much smaller than the amount which would be considered sufficient in this country. For instance, in a number of the large Elementary Schools in Berlin, taking those of much the same size, viz., schools containing about thirty-six class-rooms, which would mean not less than 2,000 children, the sites, including all buildings, vary from 4,500 to 6,500 sq. metres, *i.e.*, from just under an acre to about $1\frac{1}{6}$ acre. The area of the buildings varies from 1,500 to 2,000 q.m. A further 500 q.m. must be deducted for the usual gardens in front, leaving the space available for playground between 2,500 and 4,000 q.m. This means about $1\frac{1}{2}$ to 2 q.m. per head, or say 15 to 20 sq. ft. In some places considerably less is found. In Leipsig, for instance, in the case of a school for 2,070 children, while the area of the whole site comes to 6,200 q.m., or about $1\frac{1}{4}$ acre, of this, when the space occupied by buildings, gardens, &c., has been deducted, there is only left 2,214 q.m., or scarcely more than 1 q.m. (10 sq. ft.) per head for playground. These gardens have, however, the advantage of keeping the buildings back from the street, and so stopping the noise, besides adding considerably to the appearance of the school.

In the case of small country schools the amount of playground is of less importance as far as regards to ensuring light and air, where there are no buildings near; but sufficient space properly levelled and fenced in should be provided, sufficiently large for all the children during the recess. While the expense of tar-paving the whole ground is often prohibitive, it is a great advantage to have a piece so treated sufficiently large for the purpose of drill and physical exercises.

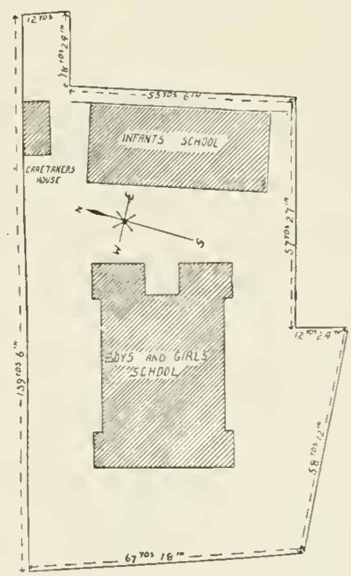
Arrangement of the Buildings on the Site.—The important points to be borne in mind in placing the buildings on the site are:—Direct access to the different departments from the school entrances—

placing the offices so that, while being fairly screened from observation, they shall be within easy access for the department to which they belong during school hours, and from the playground during the intervals. In particular, the infants should have to go as little distance as possible to their offices. If possible, the entrances should be arranged so that supervision can be maintained. In the case of small country schools it is often necessary and only to a very slight extent objectionable to have a common playground. In this case particular care is required to keep the entrances to the offices as separate as possible ; economy in drainage expense naturally involves their being placed in one block (see Fig. 291).



291.— Offices and Playground of a Small Country School.

J. T. Blackwell, Architect.

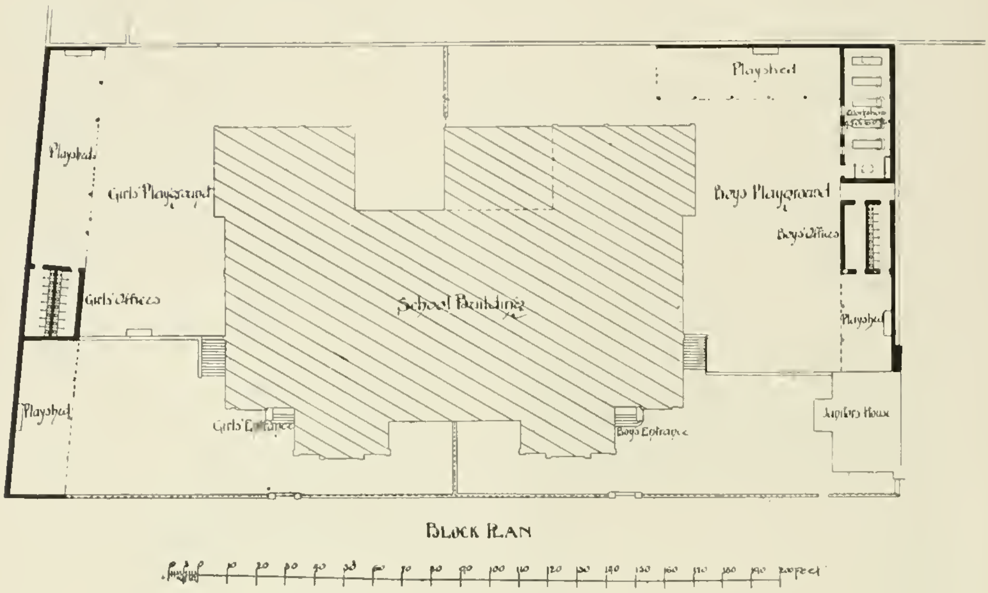


292.—Varna Street School, Manchester.

Potts, Sons, & Hennings, Architects.

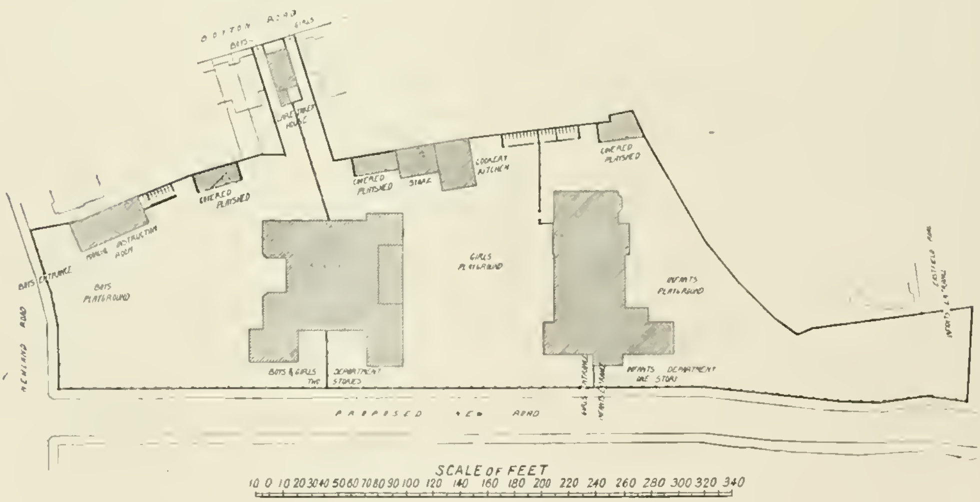
A usual plan is to place the building at one end or side of the site, dividing the playground by a wall or fence so that the boys and girls each have their playground entrances and offices, &c., distinctly divided off. This arrangement is well shown in a design for a small school illustrated below (Fig. 306), the positions of the teacher's room providing effectual supervision for both playgrounds.

In placing a large group of buildings great care should be exercised in order to avoid cutting up the playground too much. In a town where one side of the site abuts on a street the buildings should be placed well back to avoid the noise and dust.



293. THE BRUNTSFIELD SCHOOL, EDINBURGH.

Robert Wilson, Architect.

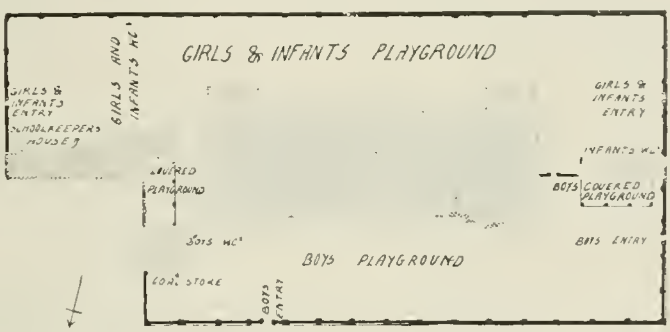


294. THE CAMPSBOURNE SCHOOL, HORNSEY.

H. Chatfield Clarke, Architect.

Separate playgrounds have to be provided for each department of the school, *i.e.*, boys, girls, and infants. These are divided from one another either by a wall or an iron railing, as may be preferred. Sometimes they are separated only by marks on the ground. The girls' and infants' playground are often combined, the same ground serving for both departments.

Fig. 292 shows the block plan of a school recently erected in Manchester. The school lies well in the middle of the ground, and would even, if built up to all round, still have enough room to obtain sufficient light and air; the Infant School, which lies near the boundary on one side, being lit, as far as the class-rooms are concerned, from the playground side. The offices, not shown, are arranged in the playground well away from the building.



295. The Cobbold Road School, Chelsea.

T. J. Bailey, Architect.

Fig. 293 shows the site plan and arrangement of the school buildings in a school in Edinburgh.

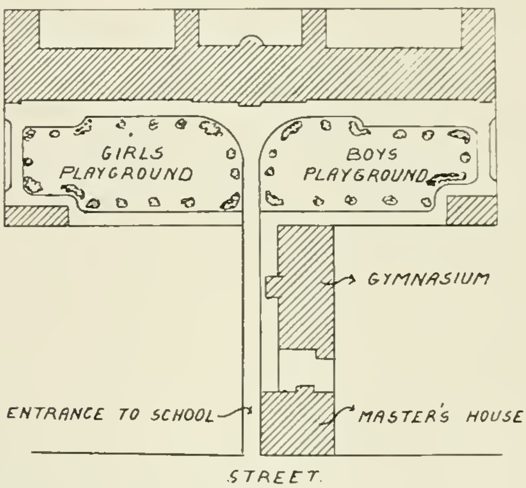
In Fig. 294 is shown the site plan of a large Elementary School recently erected at Hornsey. This plan shows well the division of the playground. There are entrances for the boys and girls each into their own playground from different streets, while that for the infants is close to the girls'. In the ground for each department is a covered playshed and offices, there being a manual instruction building in the boys', and one for cookery instruction in the girls' playground. The caretaker's house is placed at one of the entrances, and well out of the way.

Fig. 295 shows the site plan of a London Council School.

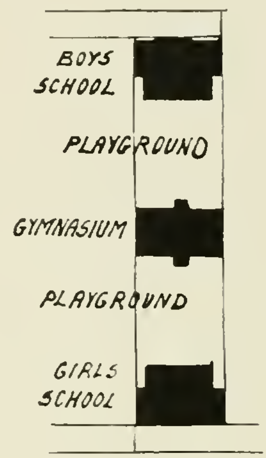
Attempts are being made to take somewhat from the rather dreary and forbidding aspect of a large Elementary School and

its playground, by planting in places where it can be done without too much chance of injury. Of course it can only be thought of where there is a considerable amount of room, and where it is not imperative to use every inch of available ground for playing room. In Germany an allowance for planting, &c., always forms part of the estimate in a building scheme.

In Fig. 296 * is given a plan showing the arrangement of a large newly built Elementary School at Berlin having a fair-sized area of ground, but with a very small frontage to the street. This narrow piece is taken up by the Director's or Headmaster's house in the street and the gymnasium, leaving a way through to the school playground,



296. Elementary School, Christburgerstrasse, Berlin.



297. German Elementary School.

on to which all the class-rooms face, thus securing freedom from noise and plenty of air. This scheme would probably meet with objection in this country, since the boys and girls must use the same entrance to the school grounds. The plans of this school with an exterior view are shown below (Figs. 352-356).

The plan of separating the two sexes is sometimes found in Germany. Fig. 297 shows a block plan of such an arrangement, the gymnasium being placed in the centre, and common to both.

Covered Playsheds.—A covered playshed should always be provided if possible, which should be, say, 60 by 20 ft. at least, and

* From Schulhygiene, A. Baginsky.

placed in the sunniest corner of the playground. Unless this is provided, children have in wet weather nowhere to play during the intervals except in their class-rooms, which cannot then be properly aired, or in the hall, where the noise would create considerable disturbance. Such a shed has also other uses; in summer, drilling classes can be taken there; children who bring their dinner to school can, if there is a seat provided at the back, eat it there, and so avoid using a class-room for this purpose. The easiest and cheapest plan to accomplish this is to put up a corrugated iron covering in a corner of the playground, making use of the boundary walls to form the back and one side.

A drinking fountain should be always supplied in the playground, the water to which is best laid on direct from the service main.

Where many children bring their dinner, it is as well to provide some boxes in convenient situations, in the hope that the children may be thereby led to put the paper in which their dinners were wrapped.

THE HALL OR ASSEMBLY-ROOM.

The hall or assembly-room plays an important part in the discipline and organisation of an Elementary School, as well as providing facilities for drill and physical exercises, and no school of any size should be built without some provisions of this kind. Where economy has to be studied, the object can be fairly secured by the provision of a side corridor, off which the class-rooms open. The corridor in this case should be from 16 to 20 feet wide. A few schools have been built in which a large hall has been provided but placed upon an upper floor, very much after the manner of a German school.

Although a hall in such a position is useful for singing-classes and other exercises which would disturb the adjacent class-rooms, it must in such a position be regarded as a luxury, since corridors of sufficient width to prevent crushing, &c., have to be provided as well. The hall can no longer serve as the centre of the life of the school, as the place where the Head Teacher's desk can be placed, and from which supervision can be effectually maintained over the school. One of the chief arguments to justify the expense of the hall is that thereby corridors are rendered unnecessary, while a convenient gathering ground is provided in which the school can be formed up and drafted off to their respective class-rooms.

A hall can easily be supplied in the case of small schools, and there is considerable diversity of opinion as to the numbers that make

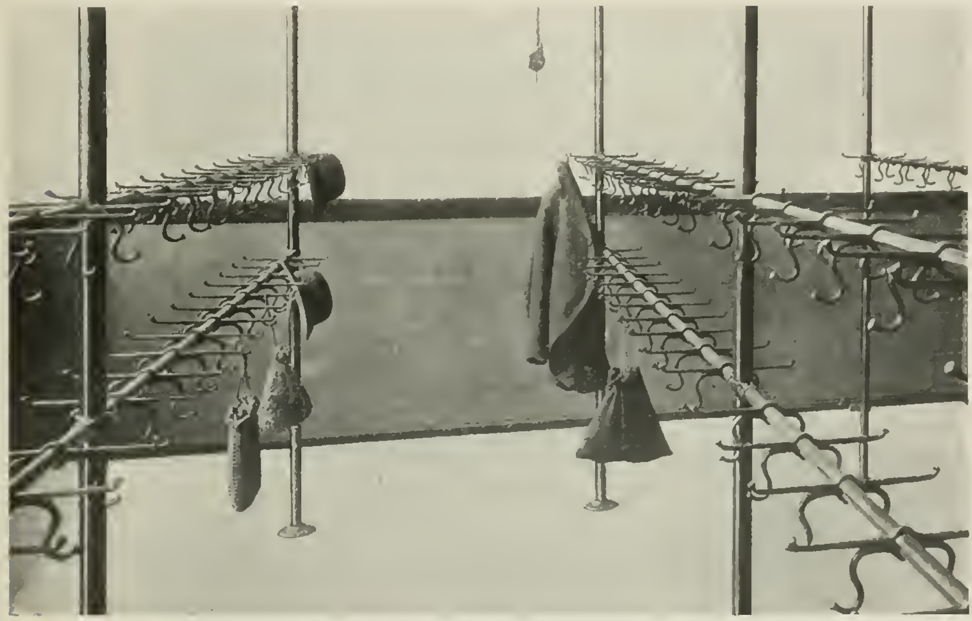
the provision of a hall desirable. This point is further considered below when considering the types of plan suitable to various sizes of schools, but even in small schools it is advisable to have the schoolroom or the schoolrooms and classrooms so arranged with sliding partitions that a room sufficiently large to take the whole school can be easily formed when required.

The hall should not be counted in the accommodation, nor should classes except on occasional emergency be taken in it, as the main use of the hall is thereby destroyed. In the case of a school organised in two departments for boys and girls it is usual to have a separate hall for either sex. A common hall can be made to serve the purpose of a mixed school, and in the case of a mixed school sufficiently large to be divided into two departments of Junior mixed and Senior mixed there may well be, if the school were a two-storeyed building, a hall on each floor for each department. In the case of large one-storeyed buildings it is usual to find a large hall for the whole school. This is sometimes made long and rather narrow, and supplied with a sliding partition in the middle, to divide it when desirable.

Other Rooms.—In addition to the class-rooms and hall there will be required for the ordinary Public Elementary Schools, cloak-rooms for each department and for the mistresses, a room for the staff and Head Teachers. This is variously arranged. In small schools there is generally only one room supplied, which is shared by the assistants and head teachers. In larger schools there may be a room for the female teachers, and another for the masters. A room for the head teacher as well is sometimes supplied. A very common method of getting sufficient room is to place these rooms on a mezzanine floor. In the Girls' Department it is necessary to provide lavatory accommodation for the teachers and for the pupil teachers, the school conveniences being always situated in the playground. Washhand basins are commonly placed for the children's use in the cloak-rooms. One or more store-rooms have also to be provided.

In arranging the cloak-rooms in an Elementary School it is important that plenty of space should be allowed all round the stands which carry the pegs, so as to allow plenty of room for the evolutions of the sort of cloak-room drill that is in vogue in many schools—that is to say, it is common to form the school up in line by classes, each of which in turn, in single file, pass into the cloak-room at one door, pass round the stand, and, depositing their hats and cloaks on the pegs as they go, emerge by the other door. In case only one door is pro-

vided, the two streams pass in the doorway. The discipline of an Elementary School generally involves a number of these kinds of marching evolutions, which should not be lost sight of in the planning. The subject of cloak-rooms has already been treated * with regard to Secondary Schools. The fittings in an Elementary School are simpler. They should if possible be so arranged as to prevent the clothes touching. A useful and sanitary form of stand is shown in Fig. 298. This has been recently adopted in several large schools in the North of



298. THE "SCHOLA" CLOAK AND HAT STAND.

From a Photograph supplied by Messrs Brookes & Co.

England. The pegs are arranged that they hold the coats and hats in such a way as to allow a free circulation of air round them. These stands are made of great strength, and are practically unbreakable. A further development of this sort of stand is shown in Fig. 298A, which illustrates part of the cloak-rooms in the Birchfield Road School, Liverpool, recently finished. In this case the stands are filled in with wire netting, which, while allowing of free ventilation, prevents caps being thrown about, or entrance by unauthorised persons.

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* See page 127.

The class-rooms, halls, cloak-rooms, and teachers' rooms may be considered the minimum accommodation necessary for an Elementary School. Further rooms are occasionally found, such as a properly lit studio in which to teach drawing instead of the class-room, a room for manual instruction, and in many cases schools have accommodation for teaching cooking or laundry work, or carpentering for boys. Schools having this additional accommodation are often used as centres, and classes come to them from neighbouring schools for instruction in such

298A. PART OF THE CLOAK-ROOM, BIRCHFIELD ROAD SCHOOL, LIVERPOOL.

From a Photograph supplied by Messrs Brookes & Co. *Willink & Thicknesse, Architects.*

subjects, for which they have not the necessary facilities. Chemistry and Natural Science are also taught in the Elementary Schools by a system of peripatetic teachers, who take their apparatus round with them in order to show the necessary experiments; each such teacher visiting a number of schools at regular intervals, the class teacher as a rule going over the work again, without of course doing the experiments. This rather makeshift method of teaching science

is perhaps the only way in which it can be managed under existing circumstances, as science rooms are not yet, as is usually the case in Germany, found in our Elementary Schools. The Higher Elementary Schools, or, as they are called, Higher Grade Schools, are provided with excellent and well-equipped laboratories, which are described when dealing with that class of school.

CHAPTER XVIII.

INFANT SCHOOLS.

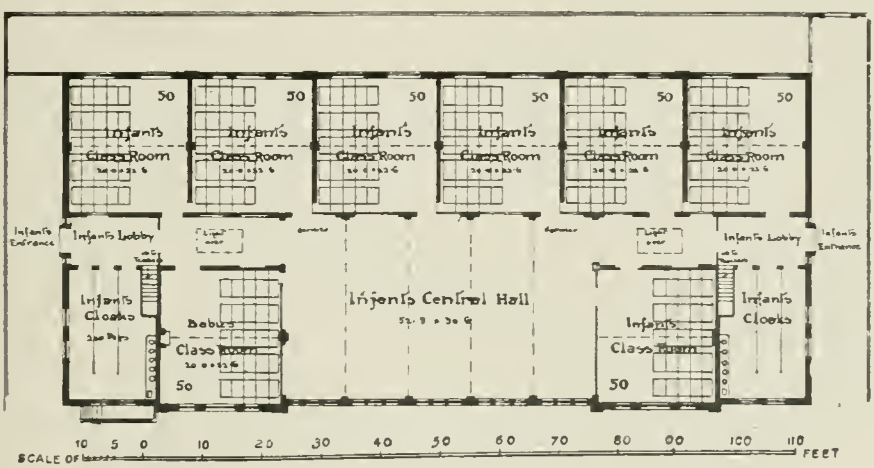
Infant Schools peculiar to this Country—*Crèches* and *Écoles Maternelles* in Germany and France—Size of Infant Schools—Long Hours for Infants—Arrangement of Infant Schools—Aspect—Infants' Departments in Larger Schools—Galleries—Area—Temperature—Description of an *École Maternelle*—Occupation Rooms—Example of French School—German School.

AN Infants' School attached to and forming a necessary part of every Elementary School is an arrangement peculiar to this country. This is due to the fact that compulsory attendance at school begins here at an earlier age. All children over five years are bound to attend school, while any child over three may be admitted—a concession of which considerable advantage is taken, especially in the poorer districts, where many parents, anxious to go out to work, are very glad to be relieved of the care of their children during the day. The result of this is that it is necessary to supply special buildings or to set apart certain rooms for the reception of the children who are not old enough or sufficiently advanced to start work in the lower standards of the Elementary School.

In Germany children are not under compulsion to attend school until they reach the age of six, when they enter the lowest class of the regular school. But although the Government schools make no provision for the young children, there are a number of institutions known as "Krippen" or "Kinderbewahranstalten." These, for the most part founded and maintained by private benevolence, are not intended so much to give systematic instruction as to provide a place where the children of the poorer classes between the ages of three and six, who cannot be properly looked after at home, may have a place in which, by means of suitable games and exercises, and, if necessary, by the provision of meals, they may have full opportunity of healthy development.

These institutions are closely modelled upon the French *crèches*, or, as they are more usually termed, *écoles maternelles*, which have long been recognised as an important feature in the scheme of elementary education, and to the building and arrangement of which great attention has been paid for many years. They are, however, as a rule, complete schools in themselves and do not form a regular department of the Elementary School, though it is not uncommon in France to find rooms for the accommodation of young children forming part of an Elementary School group.

These buildings are described and illustrated below. It is interesting to note what a small proportion the class-room accommodation bears to the space provided for exercises and rooms in which the children can do elementary manual work.



299. Mora Road School, Willesden. Infants' Block.

G. E. T. Laurence, Architect.

Generally speaking, in this country the children remain in the Infants' School or Department until between the ages of seven and eight. They then start work in the first standard of the Upper School proper, for the work of which they are supposed to be ready.

The result of this is that the Infant School has to be sufficiently large to act as a feeder to the Upper School, and by its division into classes becomes practically a copy in its organisation, &c., of the school for older children. This is well shown by the plans, which, in the case of the large schools where the Infants' Department is necessarily of a considerable size, are upon precisely the same lines as those of the

school for the older children (see Fig. 299), consisting simply of the requisite number of class-rooms opening off a central hall or wide corridor.

As the younger children are in so many cases brought to and from school by their elder brothers and sisters, it is obviously a great convenience that they should remain at the school during the same hours. There is, however, little doubt that these hours are unduly long for very young children to pass in class-rooms of the ordinary type, and further, whether injurious to the children or not, throw a great strain upon the teachers, who have to cope with a not unnatural restlessness during the afternoon hours, especially in warm weather.

Signs are not wanting of a tendency, especially upon the part of medical officers of schools, to look with a certain amount of disfavour upon the nature of the work and arrangement of our Infant Schools, and it certainly does seem that, provided it is right and necessary to have these very young children at school, an adoption to some extent of the French system, with its complete arrangements for play, exercise, and rooms fitted with beds where the very young children can be put to sleep, might be of great benefit.

Infant School Plan.—In arranging the plan, it must be remembered that some provision of open space for drill, marching, and exercise, very desirable in the schools for older children, is a necessity in an Infant School.

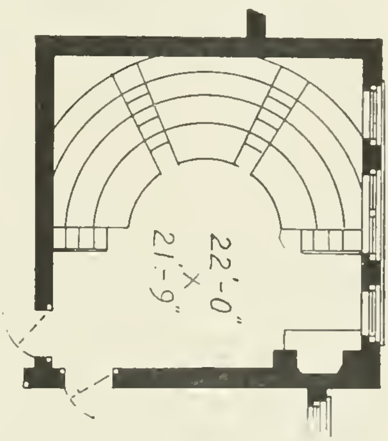
When, as in the case of small schools, it is impossible to provide any sort of hall or corridor of sufficient width, the Infants' Schoolroom must be arranged so that a wide space is left in front of the desks. This space should be at least 12 ft. wide. For this purpose it will be necessary to supply an area of floor space per head in excess of the minimum of 9 sq. ft. laid down by the building regulations for Infants' Schools. The building should be of one storey, and steps in or out are to be avoided. It should in this connection be remembered that a smooth incline, unless of a very low pitch, is more dangerous than steps.

The aspect for the rooms should be such as to ensure plenty of sun, and the access to the playground should be simple and direct, so that there may be little hindrance to taking the children out for a few minutes. The playground should be on the warm and sunny side of the building and have a part covered in. A few trees at a suitable distance will add to its comfort and appearance. The material usually provided for playgrounds—asphalte, tar paving, or gravel—is rather

hard and rough for very young children. The French regulations forbid its use, and suggest that the playground should be covered with sand.

In cases where the Infants' Department is in the same building as that of the older children, great care must be exercised in order to secure that the division shall be as solid and noise-proof as possible. This will be rendered difficult in the case of small country schools, partly from the fact that the Head Teacher must be able to exercise supervision over the work in the infants' class, and partly from the construction of the room. It will often happen that the Infant Room is formed by cutting off the necessary space from the main room by means of movable partitions, objection being made to a solid wall that it prevents full use being made of the room for meetings, &c. The noise from the Infant School will in such cases undoubtedly interfere to some extent with the teaching in the adjoining room. Something may be done to mitigate this by making use of double partitions. It should be remembered that glass is more impervious to sound than wood.

In a school of any size some space, either in a large porch or vestibule, should be provided in which the parents, of whom there are often a considerable number who come to fetch their children from school, can wait.



300. A Babies' Room.

It is usual to set apart one, or, if the school is large, two rooms for the youngest children called "babies' rooms." This room should have a sunny aspect. The side from which the lighting comes is not of much importance, but it must not be in the face of the teacher or children. An open fireplace is generally considered advisable, whatever the form of heating in use at the school. The room is sometimes fitted with a gallery, which may conveniently take a semicircular form, as in Fig. 300. But there is a considerable diversity of opinion upon the point of galleries. Once universal for infants, they are now seldom found except in the babies' room, and even here there is a strong tendency now to leave this room with the floor level and not fitted with any fixed furniture, its place being taken by the use of small tables and chairs, such as are described and figured above (see page 143) when dealing with Kindergartens.

The plan of having fixed seats round the walls, and so leaving the

floor space clear, with a movable table or desk for the teachers, is now being tried, and seems successful.

A large amount of cupboard space should be provided, and wood rails placed in the walls for pinning upon. The sills of the windows should be kept low, and everything done to make the room light and cheerful.

The ordinary class-rooms in the Infant School are arranged exactly in the same way as those for the older children, the only difference being in the smaller size of the desks and the slightly smaller room due to the fact that the building regulations of the Board of Education allow the area of an Infant School to be calculated at 9 sq. ft. instead of the 10 required in the case of the older scholars. If funds permit, the larger allowance should be adhered to.

Special attention should be paid to the warming and ventilation. The Infant School should be maintained at an average temperature, a degree or two above that of the school for the older children.

Various plans of separate Infant Schools are shown in Figs. 319, 324, 332, which are well adapted for the schools as at present organised. The examples of small country schools given in the next chapter will show rooms for the Infant School forming part of the building. There is, however, some likelihood that Infant Schools may develop more in the direction of providing more space for exercise and organised games and giving less attention to systematic instruction. In this case a modification in the type of plan will necessarily follow. With this in view, a short statement of the arrangement usually followed in the *écoles maternelles* is given below, with some examples of these schools, showing how this sort of Infant School has developed in France. No doubt, institutions of a somewhat similar nature would be required in this country in the event of the minimum age of school attendance being raised to six years—a possibility that is at times discussed, but does not at present seem in any likelihood of adoption, or of the refusal to take in children under five.

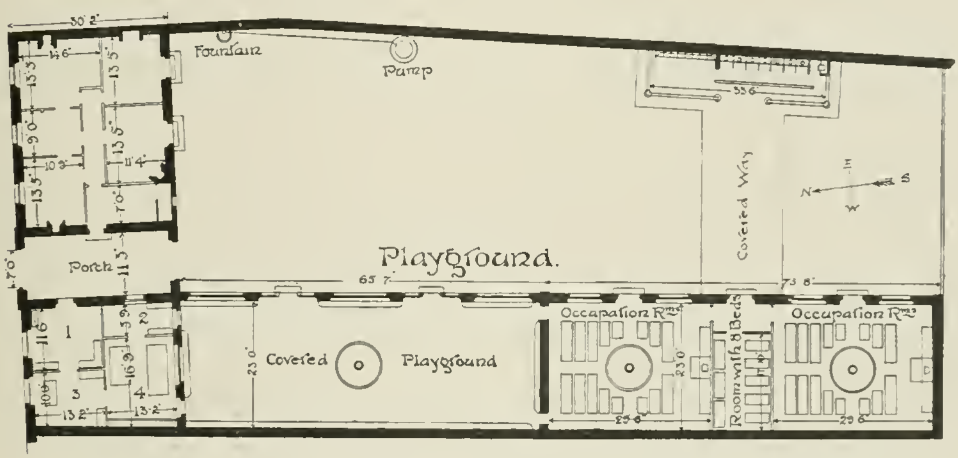
The construction and arrangement of the *écoles maternelles* in France are determined by a special series of regulations issued in 1887, which may be briefly summarised as follows :—

The school should provide an entrance vestibule forming a waiting-place for parents, one or two *salles d'exercise* (these are the rooms in which any teaching that is given is done ; they are arranged chiefly with a view to easy work with the hands, and may perhaps best be described as occupation rooms), a covered-in play-room, a kitchen to prepare or warm up the children's food, a playground with a small

garden, the offices with a covered way for access, a room for the mistress. In addition to these there is in many cases a room with a certain number of beds in it, to which any children that require it can be put to bed. About one bed to 10 children is suggested as the requisite proportion.

The site should provide not less than 8 to 9 cm. (about 85 sq. ft.) per head, the minimum area in any case being not less than 475 sq. yds. It is recommended that, where the school forms part of a group, it should not be placed between the Boys' and Girls' School.

The occupation rooms should, if possible, not be adjacent, but



301. EXAMPLE OF A FRENCH ÉCOLE MATERNELLE, CHATEAU CRIANT.
1. Waiting-room for Parents. 2. Lavatory and Teacher's House. 3. Kitchen for School. 4. Dining-room.

should be connected either directly or by wide corridors with the play-room. It is a common plan to place one at each end of the play-room.

The open playground must provide at least 30 sq. ft. per head. Sand is given as the most suitable material for the surface. Asphalte, tar paving, or cement are objected to as being too hard for very young children. Trees should be planted, but carefully arranged not to interfere with the space available for games, and there should be a small garden attached.

Fig. 301* shows the plan of an *école maternelle.* Exigencies of

* Taken from "Guide Pratique pour la Construction des Écoles." Leray & Labeyrie. 1903.

site prevented the use of more than one side for lighting purposes. The light is ample, but generally a preference is shown for lighting occupation rooms and play-rooms from two sides. The school has accommodation for 150 pupils, and contains an area of about 2,000 sq. yds. A room containing eight beds is placed between the two occupation rooms, so as to be well under supervision. At the other end of the building is a kitchen, dining-room, and waiting-hall for parents. A teacher's house is attached. The cost of the whole amounted to about £1,680.

It is now permissible for Local Education Authorities to refuse the admission of children under five years old. Previously, children between three and five could attend school as long as there was room, but could not be forced to do so. In many parts of the country advantage is being taken of this regulation, but probably not so much from any theory as to the inadvisability of allowing such young children to attend school, as from the fact that the exclusion of these children saves space and the consequent expenses of building.

Chapter XIX.

THE PLANNING OF ELEMENTARY SCHOOLS.

Variety of Schools—Large and Small Schools require a different Type of Plan—Hall and Corridor System and the Schoolroom System—Small Country Schools—Special Difficulties of, and Points to be considered in their Planning—One-roomed Schools, Two-roomed Schools—Plans—Medium-sized Schools—Points to be considered in their Planning—Size of Classes.

It is not possible to formulate any scheme of building that can be taken generally as the normal type of plan suitable for an Elementary School. The arrangement of a large town school differs in principle as well as in size and number of rooms from that of a small country school. In the former case the large numbers make it possible to divide the school into classes of a sufficient size to be provided with a separate class-room and a duly qualified teacher ; the duties of the Head Teacher are then practically confined to supervision, while in a small school he has not only to superintend the work generally, but probably do most of the teaching himself, taking two or three classes in one room, assisted perhaps by one or more pupil teachers.

The large school must be provided with a number of class-rooms each complete in itself, well and compactly arranged, with easy and convenient access to facilitate the rapid movement of large numbers and allow complete supervision. The result of this is that a plan in which all the class-rooms open directly off a hall or wide corridor has become the stereotyped form for the arrangement of a large town school.

In the case of a small country school, however, the difficulty and expense of getting and maintaining a sufficient number of duly qualified instructors, and the necessity for one teacher to take two or more classes, and the greater reliance placed upon pupil teachers, have necessitated a type of plan that will provide for the teaching of several classes in one room, where the pupil teachers can do their work with the assistance and under the immediate supervision of the Head Teacher.

This arrangement is a survival, somewhat modified in detail, of the older type of school that was in vogue at the time when the organisation

of even the largest schools was based upon the collection of a number of classes in one room, taught by a qualified teacher, assisted by pupil teachers.

The form that the plan takes is that of a large room, generally of a long and narrow shape to facilitate the arrangement of several small classes, capable of seating from 80 to 100 children, with one or two class-rooms opening off it.

This type of plan has, except in the case of very small schools, little to recommend it ; there is no place for assembling the school for physical exercises, the use of the class-rooms opening off the main room causes disturbance, and its popularity is due more to a desire for economy than to any intrinsic merit in the method. It is interesting to note that there is nothing corresponding to this type of school either on the Continent or in America. In other countries only fully qualified teachers are employed, consequently the plans down to the smallest schools are arranged upon the principle of separate class-rooms.

It is somewhat difficult to specify exactly the number at which the corridor or hall system should supersede the schoolroom type of plan. The inconveniences attached to the latter increase seriously when the numbers are large, and it may be considered that this form of planning is quite unsuitable for schools in which it is necessary to have more than two class-rooms opening off the schoolroom ; that is to say, when the numbers in a department reach about 200, even before this, a considerable amount of inconvenience will be caused by the use of the main room as a passage room, and, unless economy has to be studied to a pitch detrimental to the school, it is better to adopt a plan by which all the rooms can be entered and left from some form of hall or corridor.

SMALL COUNTRY SCHOOLS.

Small schools situated in the country are apt in many cases to be treated with less consideration than is their due : this is probably to a large extent owing to the feeling that the trouble and expense are unnecessarily great in view of the small number that the school will accommodate ; but although in any individual case the numbers are few, yet in the aggregate there are probably quite as many or even more children being educated in these small country schools than in the large town schools upon the planning and arrangement of which so much care is lavished.

The question of the expense has no doubt much to do with this. Money is hard to get in a country parish, and even in the case of a

school provided by the Local Authority three-fourths of the cost falls upon the locality. To these must be added the feeling, unfortunately not uncommon, that questions of ventilation, heating, lighting, &c., are comparatively unimportant in the case of a school in the open country. So it happens that the question that is most anxiously debated is not what is best for the school, but what is the minimum in the way of buildings and accommodation that can be squeezed through the Board of Education. As a matter of fact, however, the small country school has various difficulties to face that are not met with, or are found to a much lesser degree, in town schools. The question of heating and ventilation* is one that perhaps offers the greatest difficulty. The cost of an installation of hot water is probably prohibitive in the first instance, and, even if this is provided, there is great difficulty in securing the services of any one competent to manage the apparatus, nor is it an economical or altogether satisfactory method of heating a building with only two or three rooms.

Open fireplaces are wasteful, and are not, unless so large as to scorch the front row of desks, capable of adequately warming a fair-sized room that has three or perhaps four outside walls. The usual method adopted is that of a stove, the pipe of which is not uncommonly carried straight up through the roof; this is a thoroughly bad arrangement, for, although the pipe does assist the warming of the room, it generally allows the escape of certain fumes that are actively poisonous. At the same time, a slow combustion stove properly arranged with a chimney, &c., is the most economical and a more or less satisfactory way of warming small schools; this is the system universally found upon the Continent.†

In connection with the question of warming comes that of drying wet boots and clothes. The children in the country have often to come to school from a considerable distance, so that on a rainy morning, after a walk through the wet fields and muddy roads, they arrive at the school thoroughly soaked. Various suggestions have been made to meet this, such as making the children all keep a pair of indoor shoes at the school. In a paper read at the recent Nuremburg Conference upon School Hygiene, Dr Angerer suggests that the school itself should keep a supply of felt slippers. If this could be done, the absence of noise, freedom from dust, and the consequent cleanness of the building, would be an immense gain to the school.

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* For the ventilation of small schools, see p. 451.

† For particulars as to the proper arrangement of stoves, see p. 444.

Considerable practical difficulties, however, stand in the way. The children could hardly be turned out for ten minutes in the playground if it involved their changing their boots, and even in the longer interval it would soon become a serious nuisance. Some arrangement should, however, be made. A small drying-room might be provided if the cloak-rooms cannot be fitted with a fireplace or stove.

Provision is required for the baskets and bags in which the children who live too far from the school to return home in the middle of the day bring their dinner. A wide shelf over the hooks in the cloak-room will serve fairly well. If there is no covered playground, a room other than one of the schoolrooms in which the meal can be taken is a great advantage.

A small room for the staff ought to be provided in any school however small, otherwise they have to use the schoolroom as a sitting-room and take their mid-day meal there ; the result of this is that the schoolroom gets no chance of being aired in the interval between morning and afternoon school. In the Continental schools the teachers' living-rooms nearly always form part of the school block, and a room for the children to have their dinner in is usually provided.

A wide porch in which early comers can wait on wet mornings should be provided.

The floor of a country school requires very frequent cleansing, owing to the large amount of dirt brought in by the children. Special and ample means for cleaning the mud off their boots should be provided. A wire mat cleaned daily is preferable to the ordinary door mat, which becomes clogged almost at once. It should also be borne in mind that the village school has frequently to serve for the purpose of a parochial hall, and will be used for meetings, entertainments, &c. The use of sliding partitions will, with care in the planning (see Fig. 302), make this feasible without unduly interfering with the legitimate object of the building.

It is desirable that provision for manual training should be made, but as yet it is uncommon to find this in small schools. In Sweden such stress is laid upon the value of this teaching that it is usual to find a large Slojd room for woodwork attached to even the smallest schools.

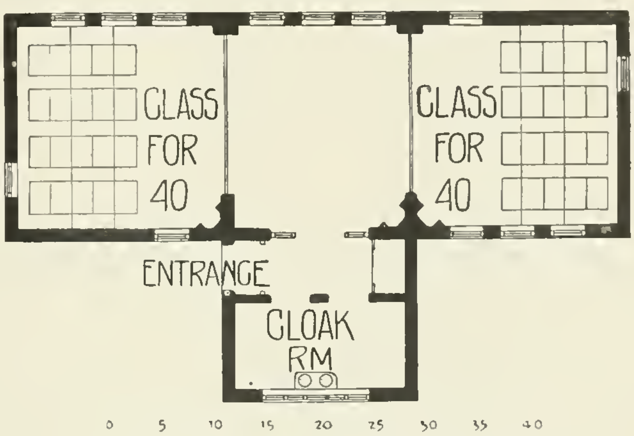
Great care should be exercised with regard to the entrances and exits, the positions of the offices,* &c. These should be well away from the building, but with a fairly direct access, especially for the infants, the approach for the two sexes properly separated ; this requires parti-

* For offices and sanitary arrangements, see below, page 469.

cular attention in the case of a school with a playground common to both boys and girls. The privacy of the girls' access must be carefully secured.*

The entrances and cloak-rooms should be separate for boys and girls. There is no objection (in fact, unless the numbers are large it is rather an advantage) for the girls and infants to have a common entrance and cloak-room, as the older girls can help the younger children. Girls and infants can also use the same block of offices.

The lighting should, as far as possible, conform to the rules for lighting class-rooms given above. But the schoolroom, when large enough to take 80 or 100 children, cannot be adequately lighted from one side—both ends will have to be fully utilised for windows, and in many cases additional lighting in the middle part will be required; in this case care must be exercised in order to avoid causing inconvenience to the teacher. Windows at the back should be arranged with the sills 7 or 8 ft. from the floor, the heads, by the use of dormers or otherwise, running right up to the ceiling.



302. Small Country School for 80.
J. T. Blackwell, Architect.

The play yards should have part covered with tar paving to provide a place for physical drill and exercise in weather when the playground is wet; this will help to keep the building cleaner. A covered shed should, if possible, be provided.

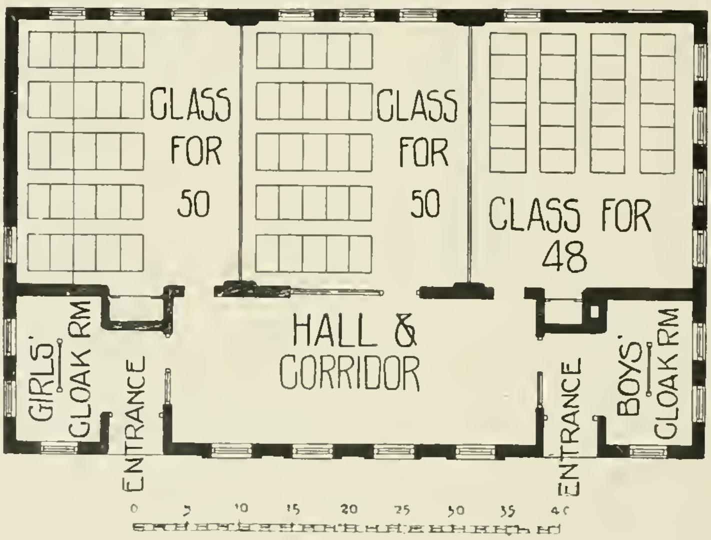
The simplest form of school consists of one room in which the whole school—boys, girls, and infants—are all taught together by one teacher. Such a school should not have accommodation for more than 50, and as soon as the average attendance reaches 40, or even before that, a separate room should be made or partitioned off in which the infants can be taught, as their instruction seriously interferes with the teaching of the older children.

The school may then be arranged as in Fig. 302. The partition

* See above, page 313.

between the infants and older children should be sound-proof, unless, as in the figure, a free space can be left in the centre. An important point, and one often overlooked, is that the infants should have access to and an exit from their room to the playground, offices, &c., without having to pass through the room where the other children are being taught.

When the numbers in the school rise above 75 (50 in the school for older children and 25 in the infants'), it becomes necessary to provide a class-room for the upper classes; it should, however, be clearly ascertained before this is done that the necessary additions to the teaching staff are to be made, to allow of a class being taken separately, as it



303. Country School for 148 Children.

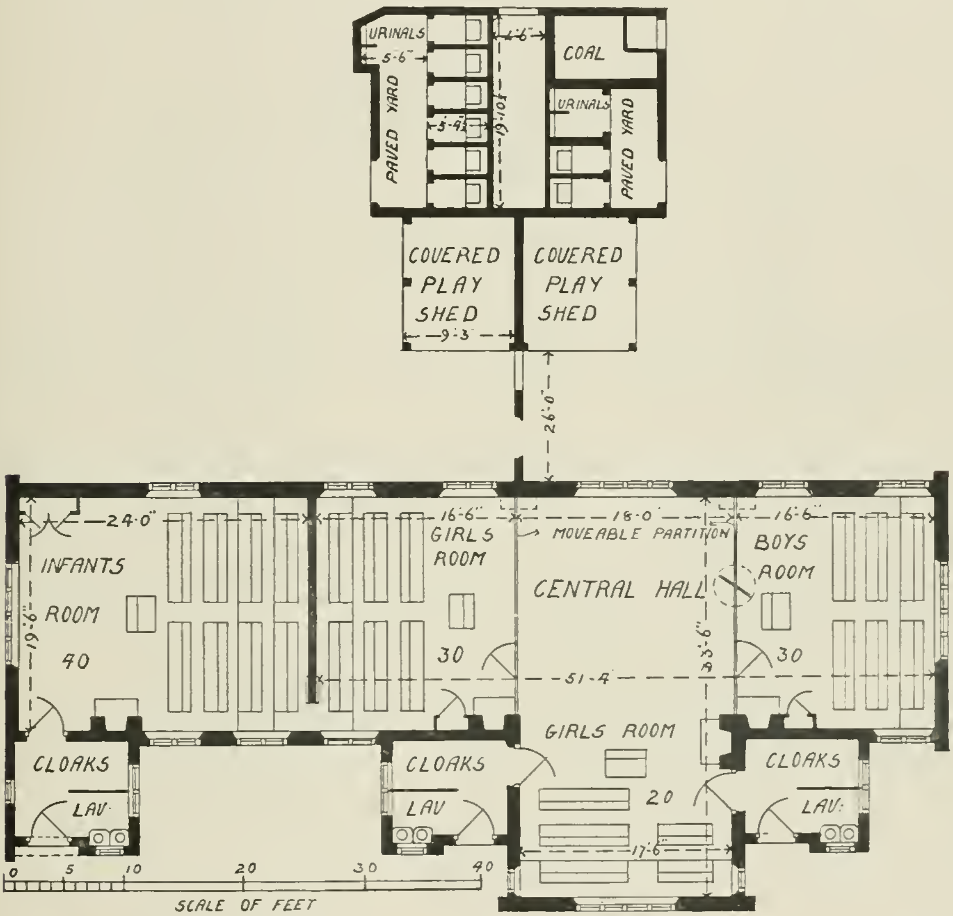
J. T. Blackwell, Architect.

has not infrequently happened that a class-room has been added to a school of which no use could be made, owing to the want of an extra teacher.

This class-room may open off the main room, and should be arranged so that the access to it is in the open space in front of the desks; this will minimise the disturbance caused by its use, and also enable the Head Teacher to keep it under his supervision. A second exit is an advantage if it can be conveniently arranged, but a door leading directly from a class-room to the open air should be avoided. For this type of school, see Fig. 307.

Various modifications can be made; Fig. 304 shows an arrange-

ment for a country school, which shows the somewhat unusual feature in a school of this size of a small central hall. When required, by the use of movable partitions a room 51 ft. long can be obtained. In this plan the direction of the lighting has been somewhat sacrificed to the other arrangements, and the smallness of the classes would entail



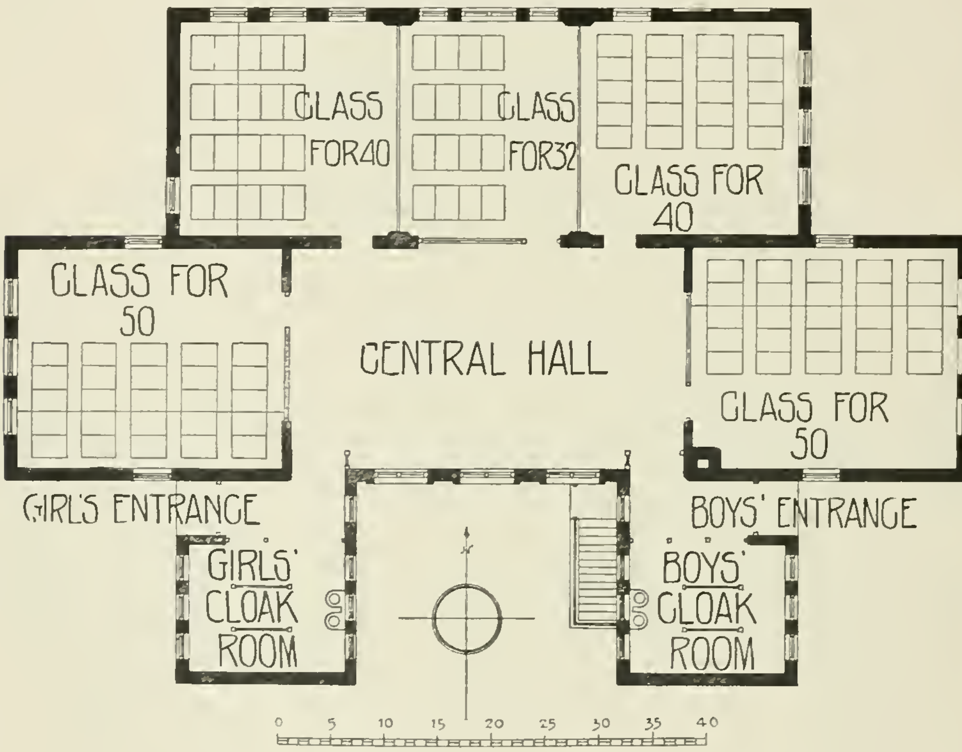
304. THE CRESSING SCHOOLS, CHELMSFORD.

Clare & Ross, Architects.

rather a high cost in staffing. The school will take 120 children, and cost about £2,000.

Even when the school reaches a greater number than is convenient for the schoolroom type of plan, the retention of a large room arranged for the seating of two or three classes may be rendered necessary by the organisation of the school. In this case the class-

rooms should be arranged so that their entrances and exits are independent of the schoolroom. Schools of this size and type offer scope for great variety in their planning and general arrangement. Much depends, of course, upon the resources available, but by careful planning and a judicious use of movable partitions, much may be done to arrange the class-rooms so that they are under effective supervision and convenient of access, while enabling a large room to be easily obtained when required.

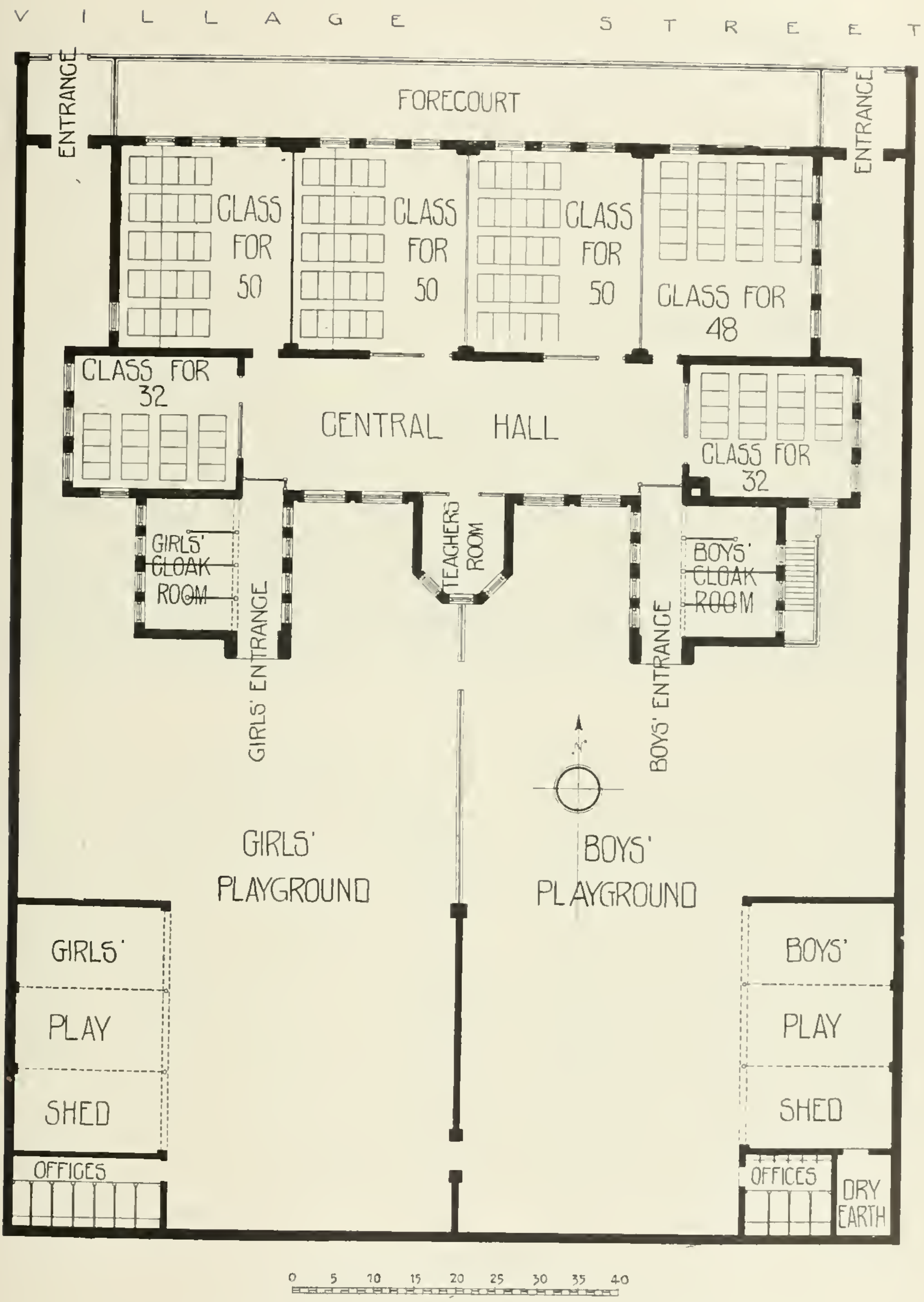


305. SCHOOL FOR 212 MIXED.

J. T. Blackwell, Architect.

Great care should be exercised in the first place to ascertain the probable sizes of the classes and the number of teachers that will be supplied, and the building then planned to suit the requirements.

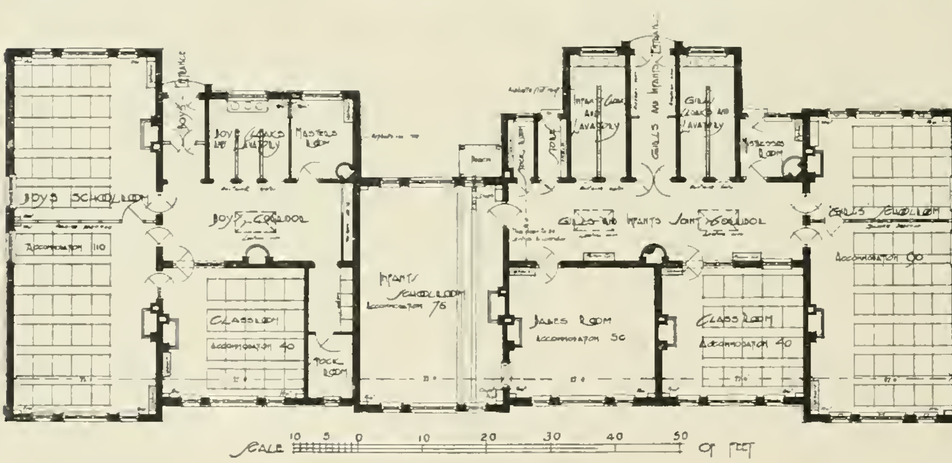
The number in the different classes will of course vary according to the locality, and the ease with which children can get leave or exemption from school before reaching the full school age, but it is usually well to provide a certain number of class-rooms for classes varying from 30 to 50.



306. Design for a Village School for 262 Mixed.

J. T. Blackwell, Architect.

If possible, a type of plan should be adopted that will allow of some form of wide corridor or hall for the purpose of physical exercise or drill.

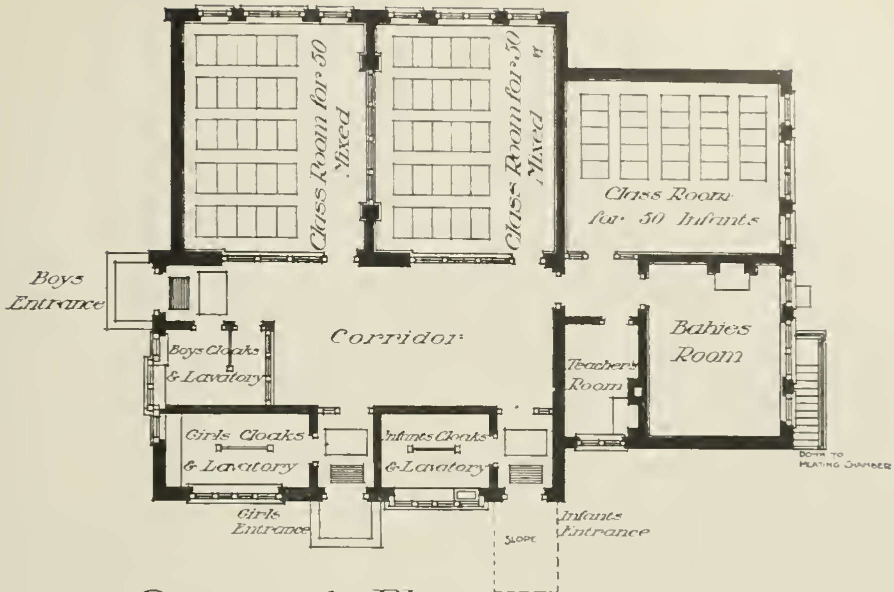


307, 308. THE CHURCH SCHOOLS, HADLEIGH, SUFFOLK.

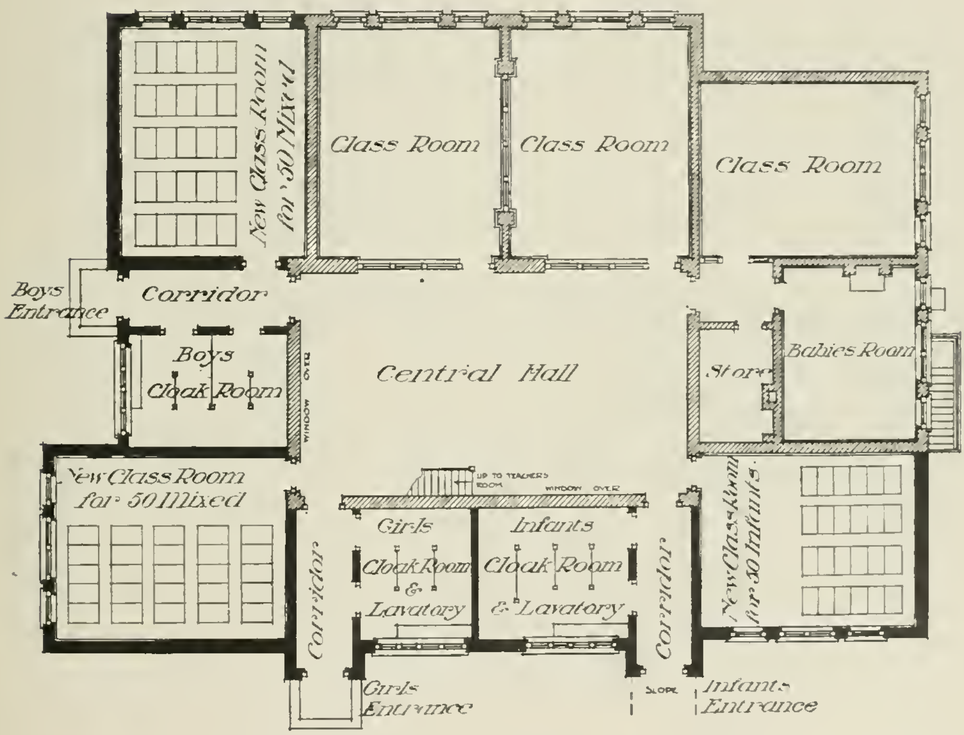
A. H. Ryan Tenison, Architect.

This principle is well illustrated in the three schools shown in Figs. 303, 305, and 306, for which I am indebted to Mr Blackwell, who has devoted much time to the consideration of this type of building.

Fig. 303 shows a building intended for 148 children, *i.e.*, 98 mixed



Ground Plan
Showing Present Arrangement



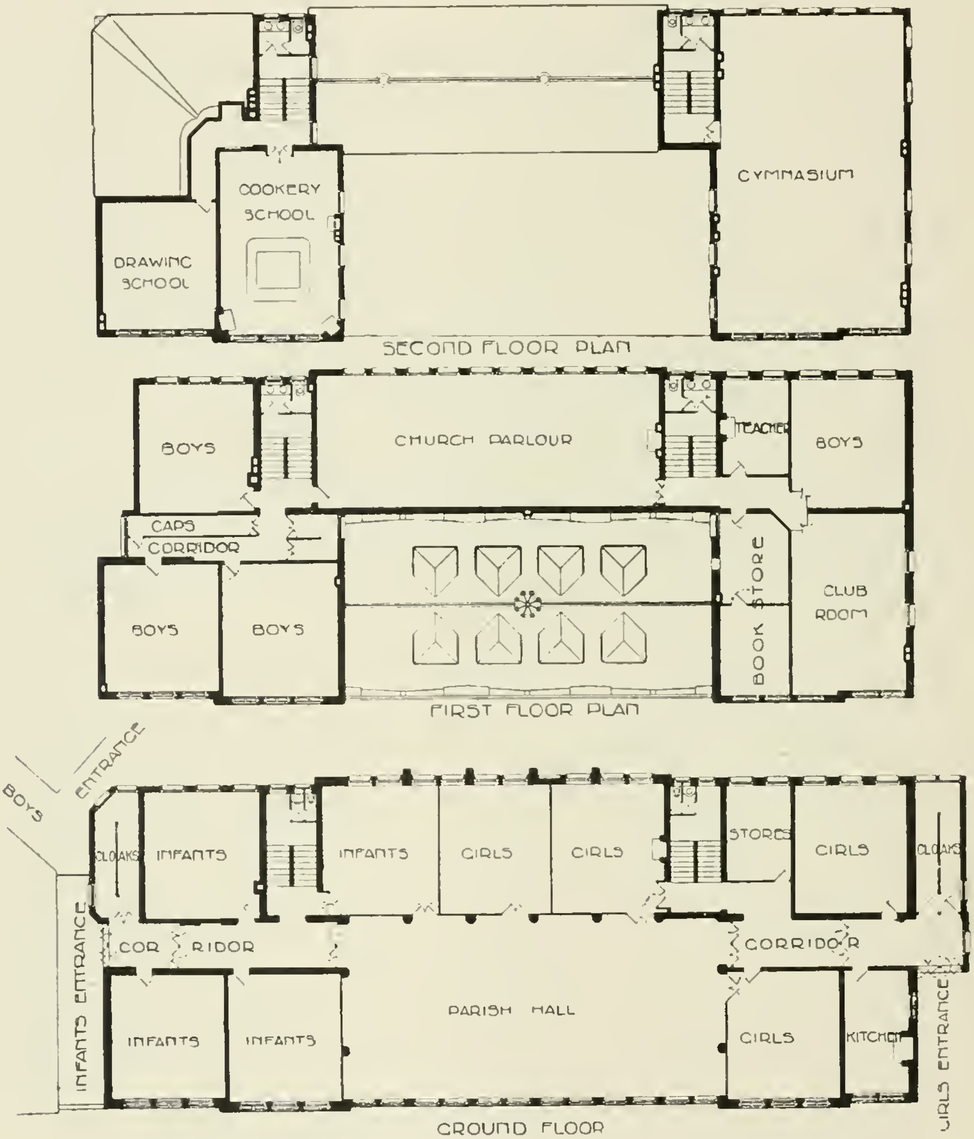
Ground Plan
Showing Future Arrangement.

10 5 0 10 20 30 40
Scale of Feet

309, 310. School Planned for Subsequent Enlargement.

Jarvis & Richards,
Architects to the Surrey County Council Education Committee.

and 50 infants; a space for marching and exercise is provided, which at the same time provides convenient access to the rooms. By the



311-313. Parochial Buildings, St James-the-Less, Bethnal Green.
E. Hoole, Architect.

addition of a class-room at each end a school for 212 is conveniently made, as shown in Fig. 305.

In Fig. 306 is shown a suggested design for a Village School to take 262 children. The problem of the most suitable size for the

class-rooms has been very carefully considered; two small class-rooms for 32 are provided for the upper classes. In all these plans great attention has been paid to secure suitable lighting. The windows that appear in the plans opposite the teachers are intended more for ventilation than for light, and are placed well in the corners, the sills being kept some 7 or 8 ft. above the floor.

The position of the teachers' room should be noted; this is intended to allow easy supervision over the playground and approaches to the sanitary conveniences. This type of plan naturally extends into the form of plan usually employed for large Elementary Schools.

A somewhat larger country school is shown in Fig. 307, the picturesque treatment of which is well illustrated in the photograph shown in Fig. 308. This school is not provided with a hall, but has a corridor of sufficient size to permit of the children being collected at the opening and closing of the school. The building was erected for just over £9 a head.

It is in many cases desirable to plan the school so that it shall be capable of subsequent enlargement without difficulty and without any sacrifice of convenience. In such cases it is probably safer to plan the whole building as it will be eventually, and then to build only so much as is required at first. A good example of such an arrangement is shown in Figs. 309 and 310, designed by Messrs Jarvis & Richards, architects to the Surrey County Council Education Committee. This is ingeniously arranged so that, when the enlargement takes place, the cloak-rooms which are temporarily placed in the building can be removed and re-erected outside, so leaving a hall of a suitable size for the school when finally complete. In Fig. 310 the hatched portions show the walls of the original building that are retained in the completed scheme.

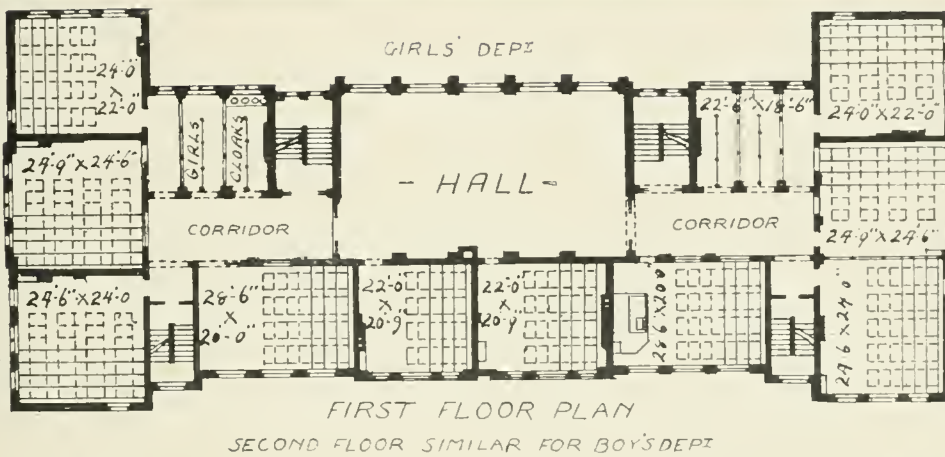
An example of a building combining a school with parish purposes is shown in Figs. 311-313, illustrating the parochial buildings of the parish of St James-the-Less, Bethnal Green.

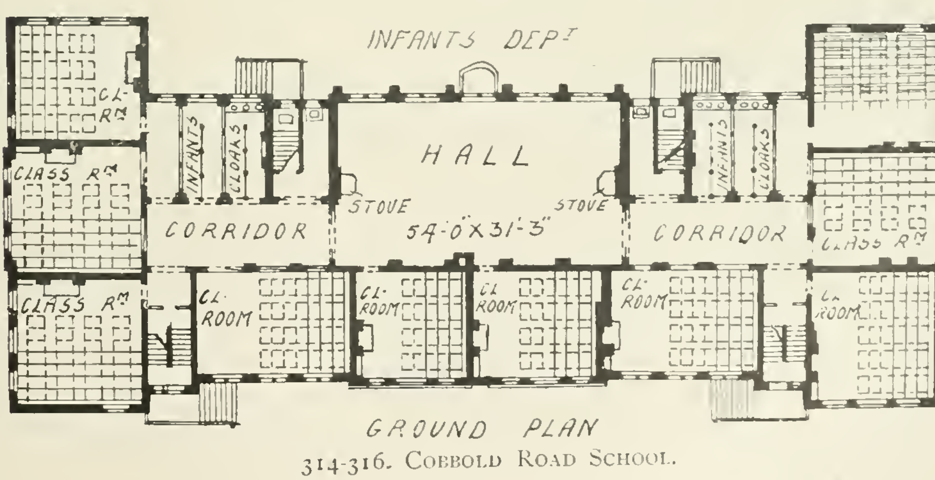
Chapter XX.

LARGE ELEMENTARY SCHOOLS.

The Planning of Large Elementary Schools—General Considerations—Different Types of Plan—Central Halls—Corridors—Examples: The Cobbold Road School, Chelsea: a Modern School of the London County Council; the Denmark Hill School, Camberwell; the Campsbourne Schools, Hornsey; the Varna Street School, Manchester; the Mora Road School, Willesden; the Conway Road School, Birmingham; the Great Horton School, Bradford; the Bruntsfield School, Edinburgh; the Broughton Road School, Edinburgh; the Alexandra Parade School, Glasgow; the Ballgate School; School in the Christburgerstrasse, Berlin; Elementary School, Mannheim; a German Town School; a Large Elementary School, Germany; Public School, Longshore Street, Philadelphia; Auburndale School, Toledo, Ohio; the Fowler Schoolhouse, Cleveland, Ohio; Public School, Pine Street, Philadelphia—Comparative Survey of English, Continental, and American Schools—Plates showing Examples of Schools from Twelve Countries—Small, Medium, and Large-sized Schools of Different Countries Compared.

The importance, in the case of a large school, of providing ample space for the movement of large numbers and the convenience of being able to collect the whole school together has for a long time made the central hall an almost invariable feature in a school of any size. The plans will therefore, for the most part, show some variation of the arrangement in which a number of class-rooms open off a central hall or corridor which is made sufficiently wide to answer practically for most of the purposes of a hall. It not infrequently happens that where economy has to be closely studied, and in order to keep the cost per head as low as possible, that although a hall is provided it is shown fitted with desks and intended to be used for educational purposes. This arrangement is a thoroughly objectionable one. The use of the hall for teaching not only involves constant disturbance and interruption to the classes taught there, but defeats most of the objects of providing a hall. If the money for providing a central hall in addition to the space required for teaching purposes cannot be found, it is better to simply substitute a wide corridor and arrange a certain number of the class-rooms with movable partitions, so that a large room can be





314-316. Cobbold Road School.

The late School Board for London. *T. J. Bailey, Architect.*

secured when required for any special occasion. This is very frequently done in American Schools (see for example Fig. 373).

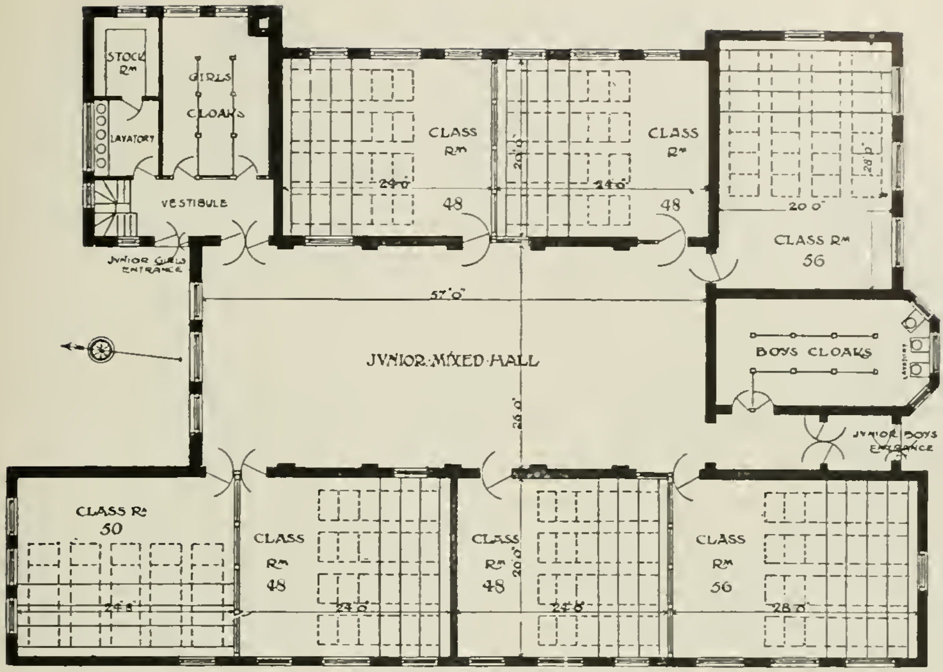
Financially, the result of omitting the hall is somewhat disappointing. A carefully planned school—such, for example, as that shown in Fig. 333 of a central hall with class-rooms on three sides of it—provides, including all the rooms in the building, about 400 cubic ft. per head. The omission of the hall and the substitution of even a fairly narrow corridor would not reduce this to much below 350 cubic ft. per head, consequently the saving may be put from 25s. to 30s. per head. Although this may be considered an appreciable saving, the building of schools without some form of central hall is much to be deprecated. The result on the plans would be to produce schools arranged on the principle of the German Schools—such, for example, as that shown in Figs. 353-356—with the same tendency, probably, for the school to split up into their classes, or, as it were, a number of little schools under one roof. The insistence laid upon the value of a corporate life to a school by educational writers is surely worthy of attention, and there is little doubt that this spirit is greatly helped and fostered by a common meeting ground where the school can have easy and frequent opportunities of being all together.

The most suitable type of plan will depend, of course, upon the method of organisation. In the case of schools divided simply into boys, girls, and infants, the plan usually adopted is that of providing three halls, one for each department. In the case of mixed schools, even when divided into a Senior and Junior mixed, it is not uncommon to find a common hall of a sufficient size for the whole school (see for example Fig. 320). A hall can be arranged as in Fig. 320 for the use of the departments at different times. In this way no disturbance is caused by those in the hall to the work going on in the class-rooms.

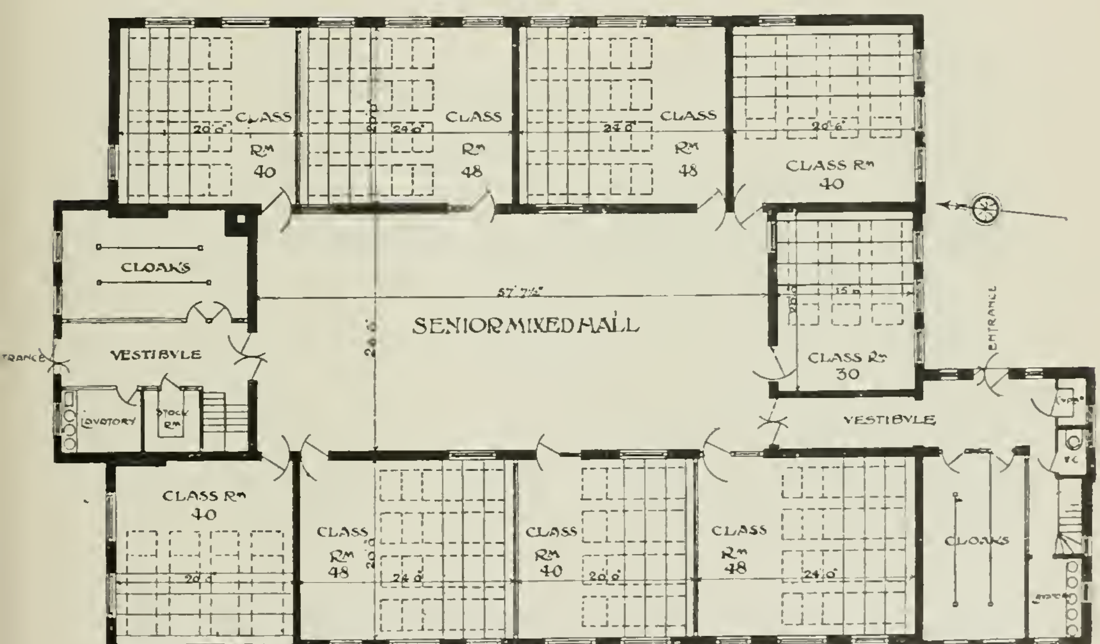
When a single hall is provided for the common use of the whole school, the plan often found in Secondary Schools of arranging for the approach to the class-rooms from a gallery is used. This is a form of plan that is very frequently found in Scotland (see Figs. 340-347).

EXAMPLES OF LARGE ELEMENTARY SCHOOLS.

The Cobbold Road School, Chelsea.—The plan given in Figs. 314-316 will show how the rooms may be arranged. This example may be considered a typical plan of the modern Elementary School as built by the late London School Board. It will be noticed on looking at the



·JVNIOR·MIXED·SCHOOL·



·SENIOR·MIXED·SCHOOL·

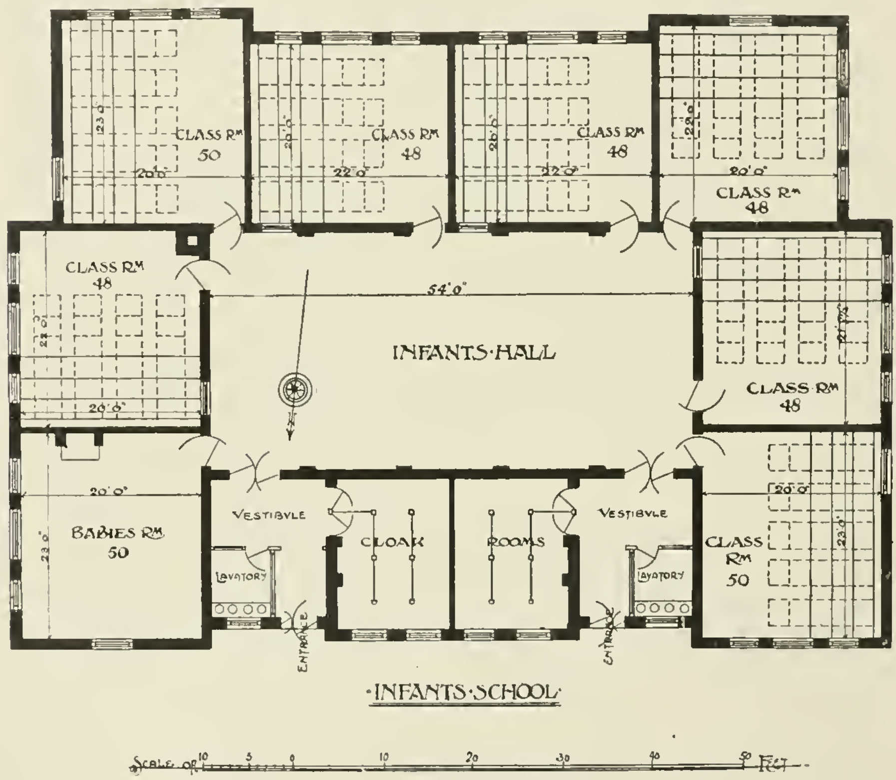
317, 318. Denmark Hill School, Camberwell.

London County Council. *T. J. Bailey, Architect.*

plan that none of the class-rooms are provided with sliding partitions so that two rooms can be thrown into one for any purpose.

The cloak-rooms are conveniently arranged immediately at the top of the stairs, and are divided into two halves, each 4 ft. 6 in. wide, with a stand down the middle. At the end are placed the lavatory basins, allowing two basins to every hundred children.

The class-rooms in this school are fitted, as in all the schools of



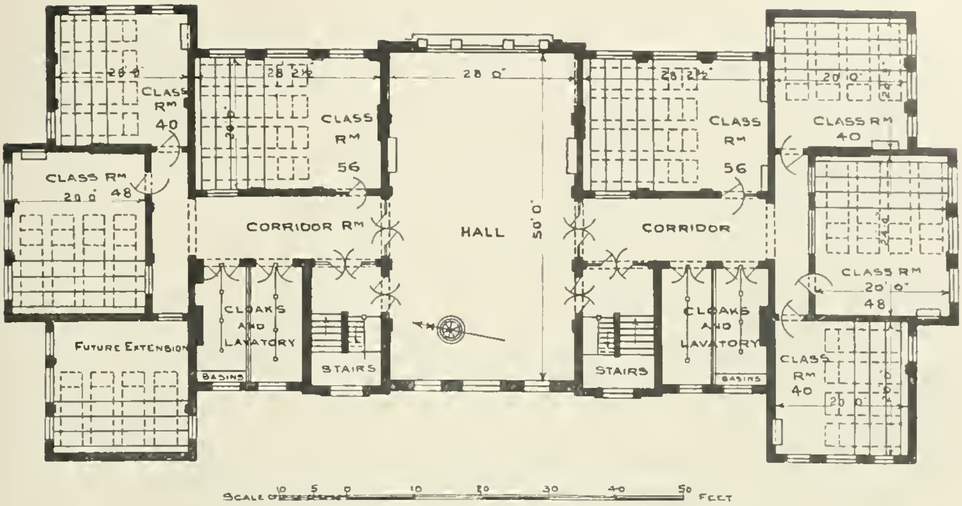
319. Denmark Hill School, Camberwell.

London County Council. *T. J. Bailey, Architect.*

the London School Board, with dual desks, the last three rows being raised. The rooms are all excellently lit, the light being brought in from one side only.

Under the Girls' Department, and arranged on much the same plan, is placed the Infant Department (Fig. 314), on the ground floor, so that there should be no steps.

While this type of three-storeyed school is found in parts of London where sites are costly and sufficient space difficult to secure, the advan-



320. DENMARK HILL SCHOOL, CAMBERWELL.

London County Council. *T. J. Bailey, Architect.*

321. DENMARK HILL SCHOOL, CAMBERWELL.

London County Council. *T. J. Bailey, Architect.*

tage of building schools of one storey only has not been lost sight of, and in the outlying districts where there has been no difficulty in securing adequate space the London County Council Schools are built in separate blocks so that all the rooms are on the ground floor. A building of this kind is shown in Figs. 317-319, in which example the school is divided into a Senior mixed, a Junior mixed, and an Infants' Department, each of which is housed in a separate block.

In the Denmark Hill School, Camberwell, a recent school built by the London County Council (Figs. 320, 321), is shown another method

322. The Campsbourne Schools, Hornsey. Boys' and Girls' Departments.
H. Chatfield Clarke, Architect.

of arranging a school with a hall placed centrally, and equally accessible for either department. An exterior view is shown in Fig. 321.

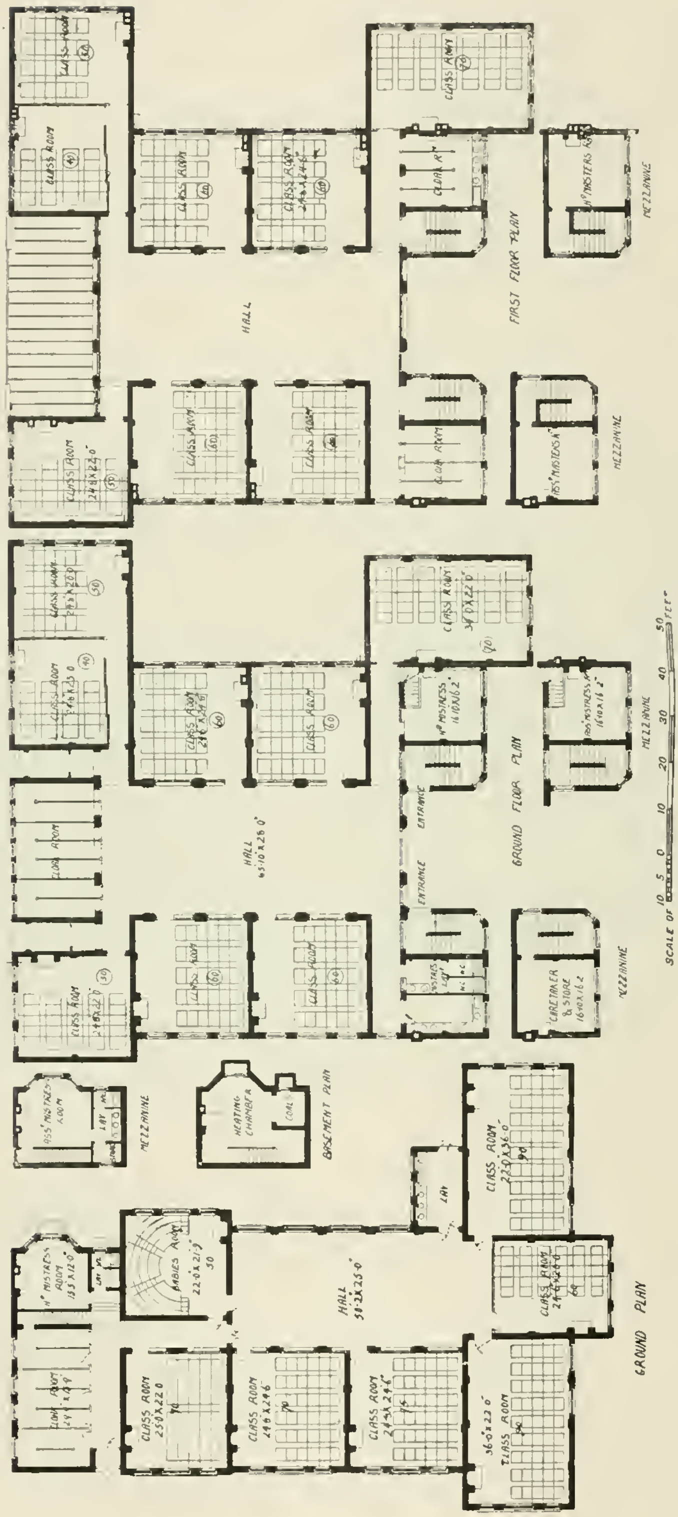
The Campsbourne Schools, Hornsey.—As an example of a two-storeyed building with the Girls' Department on the ground, and the Boys' on the first floor, with the infants housed in a separate building, the schools recently erected by the Hornsey School Board will serve as an excellent example. These schools are known as the Campsbourne Schools. The site available for the school contained

an area of slightly over 2 acres, and the number of children to be provided for 1,400. The Board, on the advice of the architect, Mr Chatfield Clarke, after going carefully into the question, decided that the school should be built in two blocks—one for the girls and boys, and the other for the infants—it being somewhat cheaper to build on this plan, in addition to the advantages gained by limiting the building to two storeys. The accommodation was settled as follows:—Boys, 450; girls, 450; and an Infant School of 510. The class-rooms are of different sizes, viz., one for 40, two for 50, four for 60, and one larger room capable of taking 70. These are exactly repeated on the floor above. On referring to the plan (Figs. 325, 326), it will be seen that these rooms are in each floor arranged on the two

323. Campsbourne Schools, Hornsey. Infants' Department.

sides of two spacious halls, one above the other, measuring nearly 86 by 28 ft. That on the ground floor is lit from the ends, and also by borrowed light from the class-rooms.

The girls' cloak-room is placed close to their entrance, with three openings into the hall, while the boys, whose entrance is at the opposite end of the building, find their cloak-room immediately at the top of the stairs, in which are placed also the lavatory basins. The boys' entrance is in a different street to that of the girls, an excellent plan if the site happens to abut upon two streets. On one mezzanine floor are provided two rooms for the assistant teachers, as well as one for the Headmaster. A second mezzanine floor between the ground and first floor gives a caretaker's and a store room. The



Boys' and Girls' Departments.

Infants' Department.

324-326. Campsbourne Schools, Hornsey

The Hornsey (U.D.) School Board

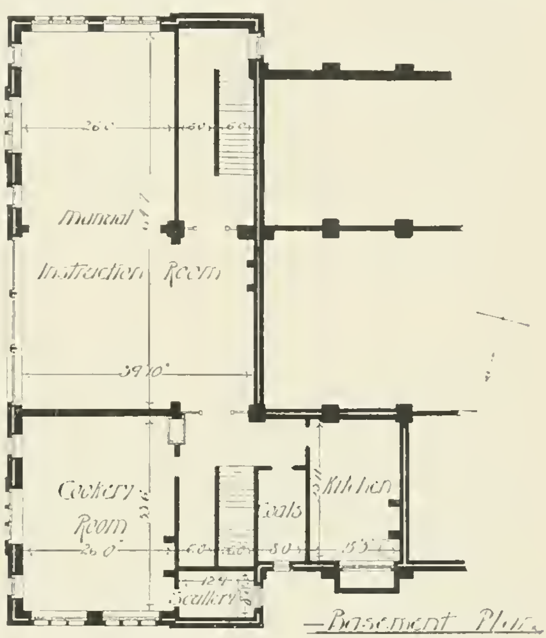
H. Chatfield Clarke, Architect.

hall on the first floor has been constructed with an open timber roof, which adds much to the handsome appearance of the school.

The class-rooms are fitted with dual desks, having the last three rows raised, and are most carefully and excellently lit, every room being lit from one side only, with an ample provision of glass area. They also receive a diffused light from the hall, there being glass partitions carried right along. It will be seen that the two class-rooms at the south-west corner can be thrown into one large room.

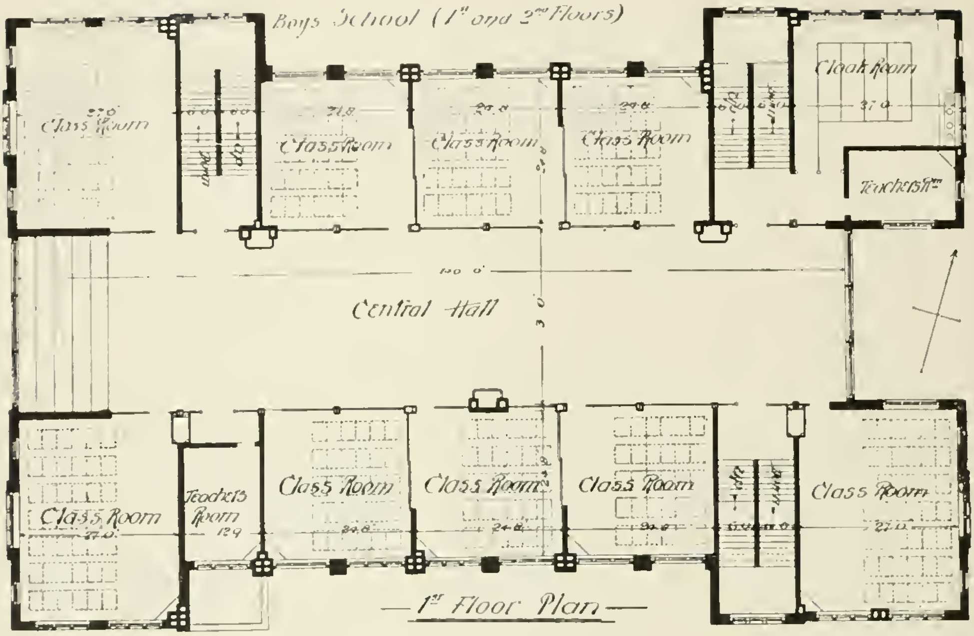
The Infants' Department (Figs. 323, 324) has a hall of 50 by 25 ft., which is in addition to the class-room accommodation for 510, the number to be provided for. One class-room at the end of the hall can be thrown into it if additional space is required for any purpose, such as marching exercises, &c. There is the usual cloak-room accommodation, and two staff-rooms — one for the Head-mistress, and one for her assistants. A feature that should be noticed is the provision of a babies' room, with circular raised seats, for the purpose of teaching very young children.

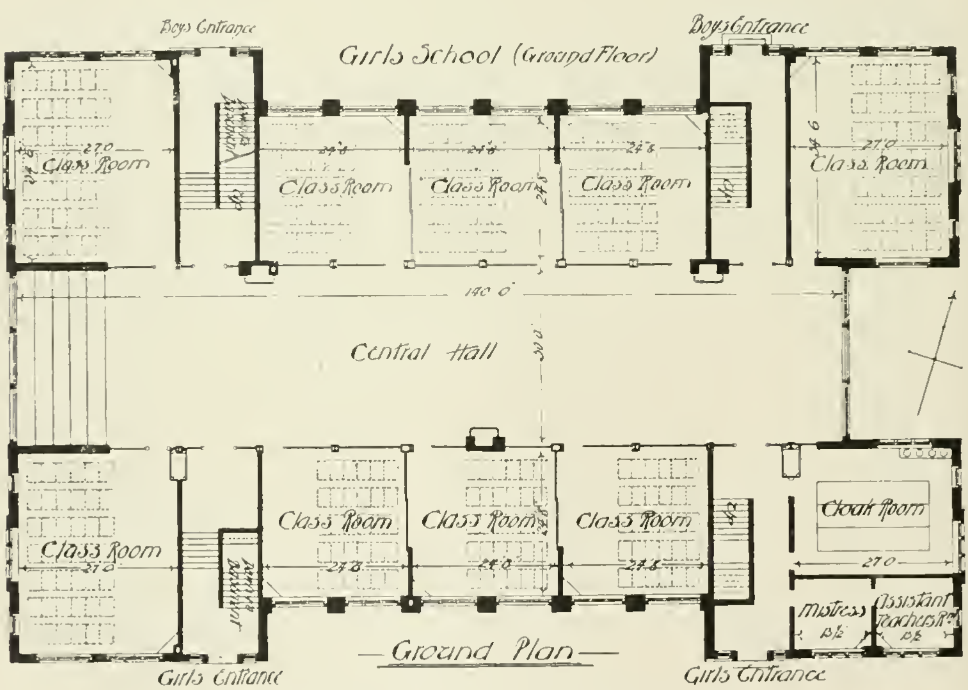
The class-rooms throughout are heated with "Boyd's" patent hot-air stoves, and the halls and corridors by a low-pressure hot-water apparatus, each class-room having a fresh-air inlet and an extract flue. The walls internally are built to the height of the dado of brown salt-glazed bricks, the upper parts being finished with buff-coloured bricks. The outside walls, built of stock bricks with red brick dressings, make a pleasing and effective exterior (see Fig. 322).



327. The Varna Street School.

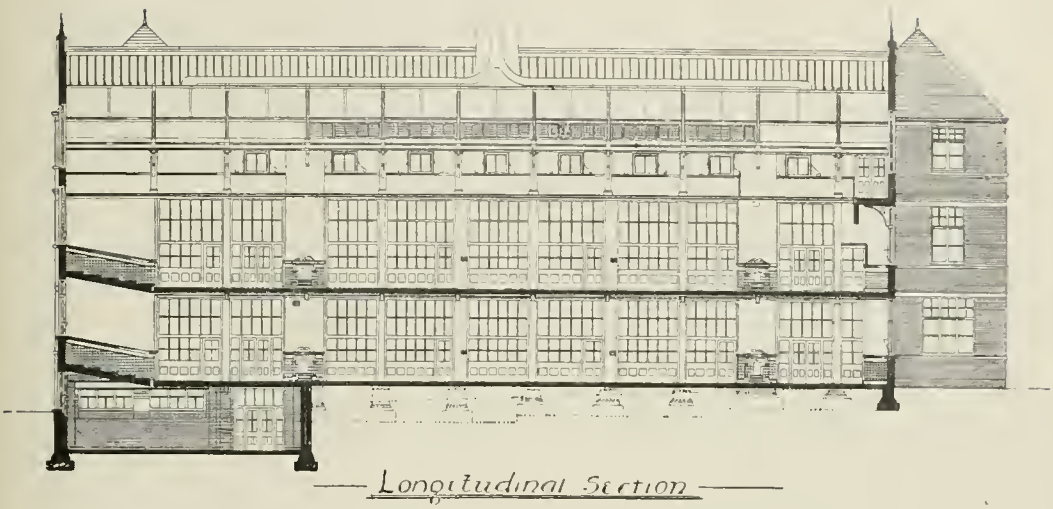
The Varna Street School, Manchester.—This is another good example of a school with a separate building for the Infant Department, and a block for the upper school, with the girls on the ground floor and the boys above, but with the addition of an extra floor containing rooms for drawing and manual instruction. This is a school recently erected by the Manchester School Board, and presents several points of interest.

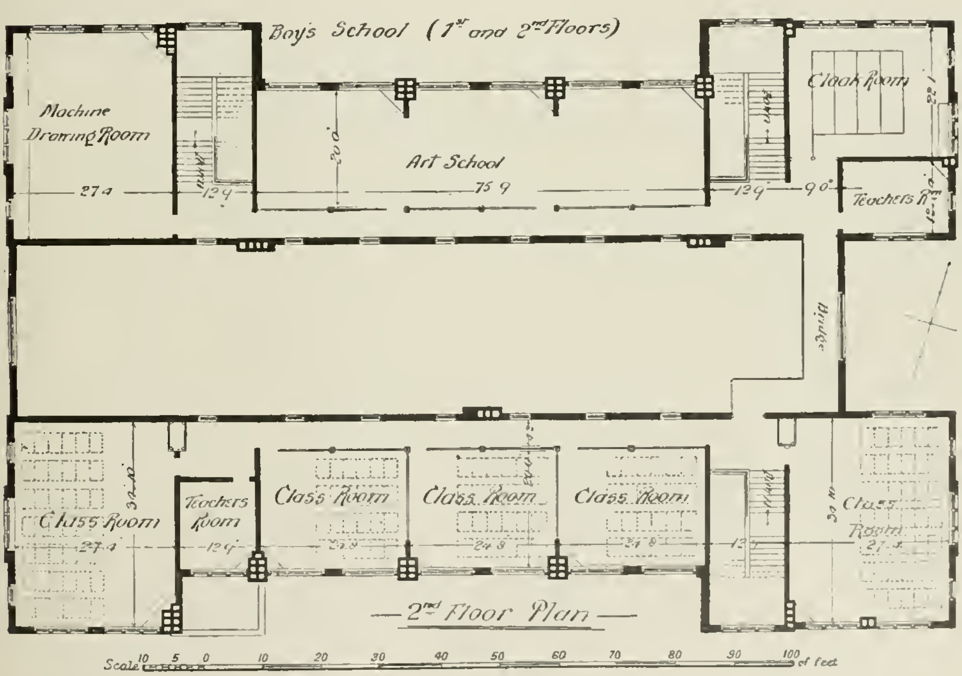




328, 329. THE VARNA STREET SCHOOL, MANCHESTER.

The Manchester School Board. *Potts, Son, & Hennings, Architects.*





330, 331. THE VARNA STREET SCHOOL, MANCHESTER.

The school was built from designs by Messrs Potts & Hennings, as the result of a competition in which some five or six architects took part. The conditions were very fully and carefully drawn up by the Clerk of the Manchester School Board, Mr Wyatt, who was good enough to take the writer over the building. The result is an interesting and very successful school, one of the most remarkable features being the very low cost of the building.

The accommodation to be provided was as follows:—School to be for 2,000, viz, 1,500 in the upper school, and 500 infants in a separate building.

The rooms supplied in the larger building are—

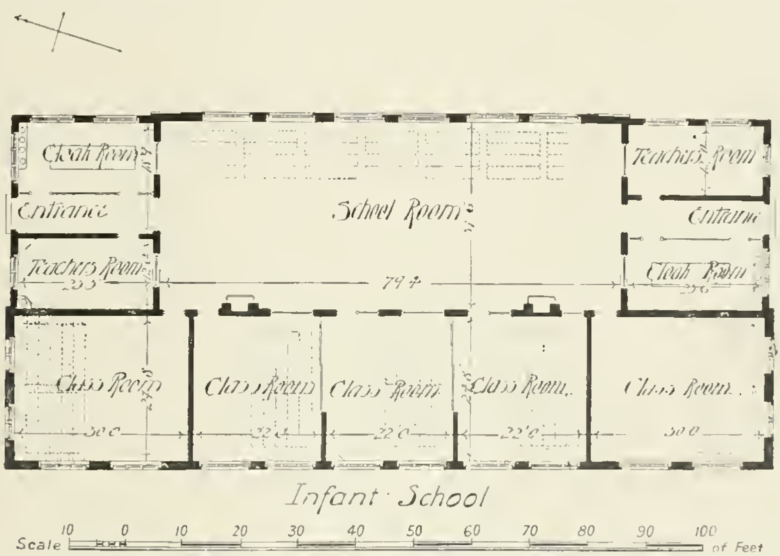
Fifteen class-rooms to hold 60 children.
Eight class-rooms to hold 84 children. These are capable of division by partitions.
Two halls, 140 by 30 ft.
Three cloak-rooms.
Four teachers' rooms for heads and assistants.
Large drawing school.
Room for machine drawing.
Manual instruction room.
Cookery instruction room.
Caretaker's room and coal-rooms.

It will be noticed that there are here given several rooms not found in the other two Elementary Schools of which plans have been given, but which ought if possible to find a place in every school in this country, as they usually do in a German school; for while in London it may be possible to give instruction in certain extra subjects by sending the children to various centres, it is very often, and especially in country places and towns, a matter of great difficulty, and in any case it is a great advantage to have facilities for doing so in the school itself.

The way in which the building is arranged can be seen on reference to Figs. 327-332, where the full plans are given.

The first point that draws attention on looking at the plan is the entire absence of internal walls in the main building. All the class-rooms on the two sides of the hall are merely shut off by glass and wood partitions, the glass running from 3 ft. 6 in. right up to the ceiling (see section, Fig. 330). The hall is of great length, viz., 140 ft., and the entire width of each end is taken up with the window. The side walls of the class-rooms, except for the constructionally necessary pier, are plain glass. The result of this, looking down the long hall, is very striking. The whole building is warmed entirely by open fire-

places, formed with "Leamington bars," there being no form of heating apparatus in the building. As the school stands in a high open position, with an unusually large area of glass, it is difficult to believe that they do not suffer from cold in the winter. However, the Headmaster stoutly maintained that the rooms were most satisfactorily warm in any weather, and that as a rule he had only one of the three fireplaces in the central hall lit, because fires near the exits were only apt to make the boys stand about by them, and moreover were not usually wanted for heating purposes. As I was at the school in the early summer, I had no opportunity of judging personally, but could not help thinking that the children of Manchester must be unusually warm-blooded.

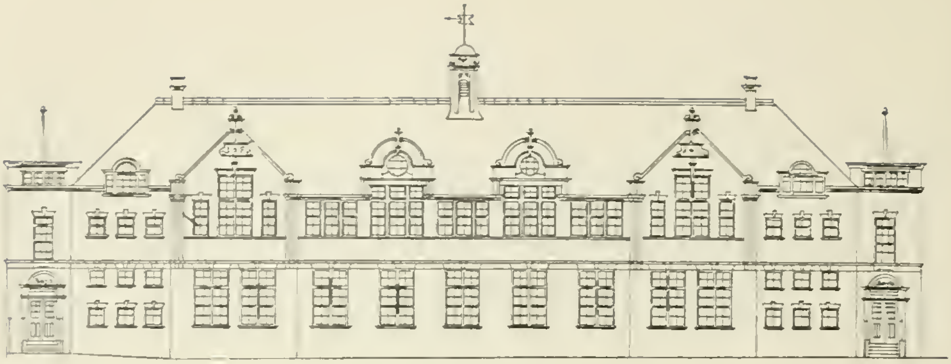


332. Infants' Department, Varna Street School, Manchester.

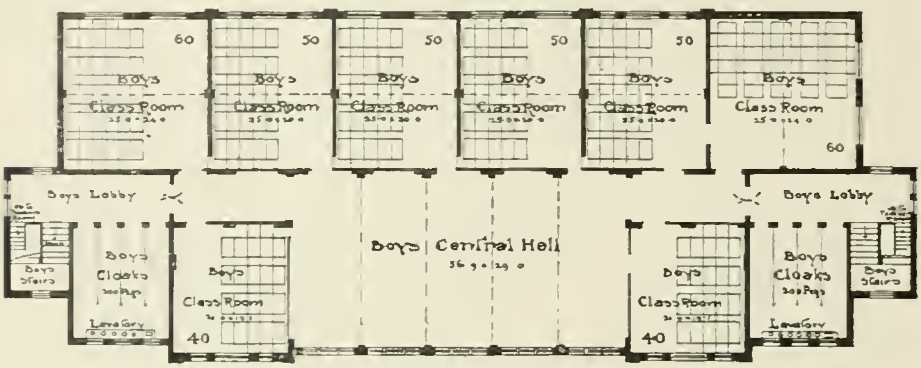
The class-rooms are so arranged that of those in the central block any two can be thrown together in a moment, if it is desirable for one teacher to keep an eye on two forms. When the partitions are pushed back, about two-thirds of the dividing partition is clear.

Dual desks are employed, and the area of floor space allowed is 10 sq. ft. The Infant School, placed in a separate block, is shown in Fig. 332, arranged with rooms on three sides of a hall.

There is in every class-room a ventilating extract flue, as there is also to the cloak-rooms. There are, however, no inlets, but the open fires no doubt assist the ventilation. The upper parts of the windows also are made to open easily. The rest of the arrangement of the rooms can be easily seen from the drawings. The idea of the building

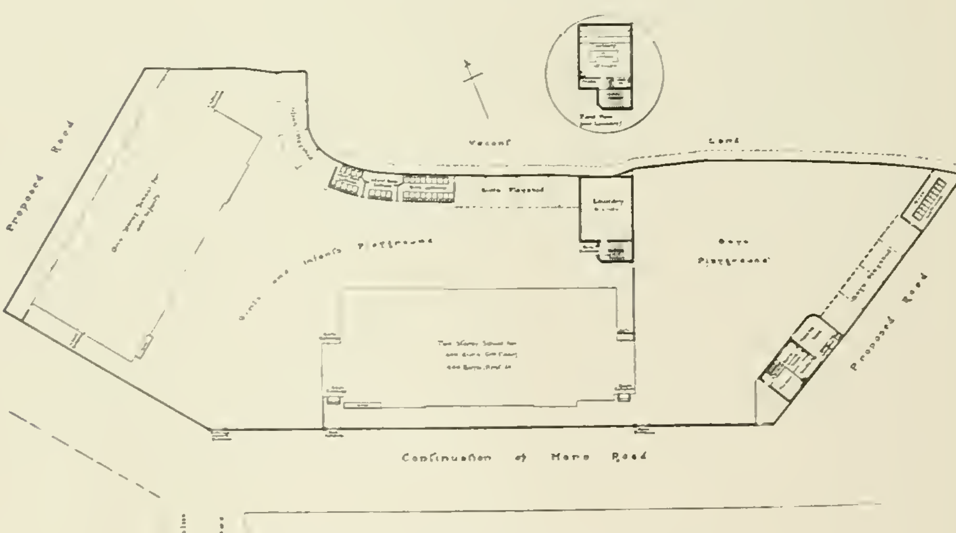


South West Elevation



First Floor Plan
Boys School for 400

SCALE OF 10 5 0 10 20 30 40 50 60 70 80 90 100 110 FEET



Block Plan

SCALE OF 0 5 0 10 20 30 40 50 60 70 80 90 100 150 200 FEET

333-335. THE MORA ROAD SCHOOL, WILLESDEN.

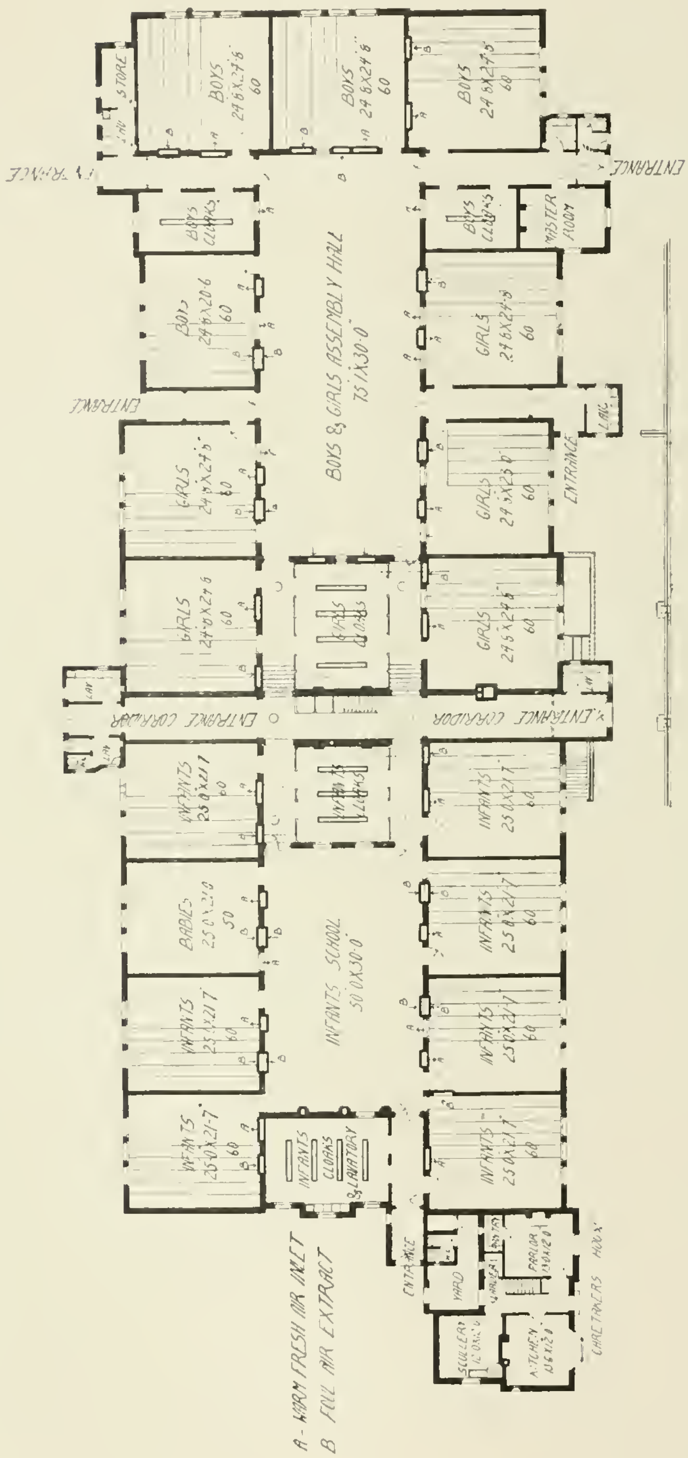
The Willesden Education Committee. *G. E. T. Laurence, Architect.*

is the same as that of a factory, being a skeleton of iron-work and brick piers filled in with glass and wood-work, the result being an effective and thoroughly useful school building, excellently lit, and produced at an extraordinarily low cost. The limit laid down by the conditions for the competition, as mentioned above, was £9 a head, and this sum had to include, in addition to the actual building, draining and concreting of playgrounds, erection of boundary walls, draining of building, offices, cloak-room fittings of wrought iron to special pattern; all school furniture, including three pianos, clocks, fittings for cookery and manual instruction rooms, notice-boards, &c.; all necessary waste pipes, meters, gasfittings, &c.; a caretaker's house of six rooms; and £30 for memorial stone. That is to say, the entire cost of the school, ready for occupation, including playgrounds, and as a matter of fact the whole of the main block for the upper school and the infants' building, was completed for little over the sum named. Externally the school presents somewhat the appearance of a factory, but it is a plain and unpretentious building, and, if not exactly beautiful, is simple and straightforward.

The Mora Road School, Willesden.—This shows a well-arranged school with two departments in one two-storeyed building, with the infants in a separate block. A laundry with a cookery-room over is placed in the girls' playground. All the class-rooms are arranged so that the light should fall from the left. The school now is estimated to cost about £16 a head, including the laundry and cookery centre, caretaker's house, &c.

The next type of school is that in which all the rooms required are arranged in one storey only, and there is no doubt that this arrangement is a very satisfactory one, but requires of course a great deal of space.

The Conway Road School, Birmingham.—This is a good example of this class of school recently completed from the designs of Messrs Martin & Martin (see Fig. 336). The school is designed to accommodate 1,050 children, in the proportions 290 boys, 290 girls, and 470 infants. The whole of the school buildings are in one block, including the caretaker's house. The boys and girls have a common assembly hall of 75 by 30 sq. ft., giving an allowance of 4 sq. ft. per head. On looking at the plan, it appears that the Infant School is very large in proportion to the other part of the school; but, as a matter of fact, the two class-rooms adjoining the older school are used for whichever department it may be found most convenient. The cloak-rooms are particularly worthy of notice. The girls' and infants' cloak-rooms are provided with windows enabling supervision to be kept upon them by



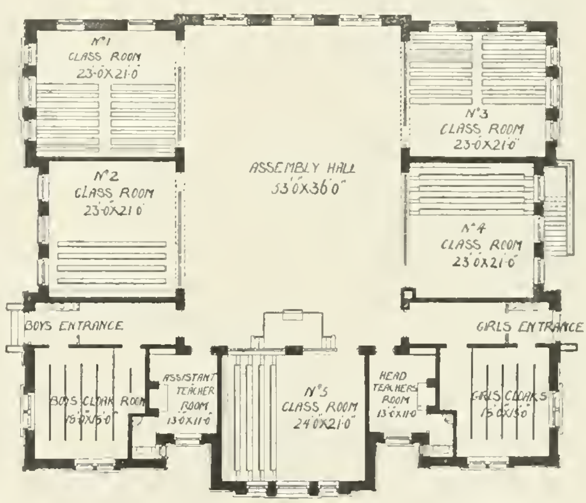
336. The Conway Road School, Birmingham.

The Birmingham School Board, Martin & Martin, Architects.

any one in the central hall; the sides next the corridor are formed of wire netting, which, while allowing free ventilation, prevents access by the children at unauthorised times. There is a room provided for the

337. The Great Horton School, Bradford.
W. J. Morley, Architect.

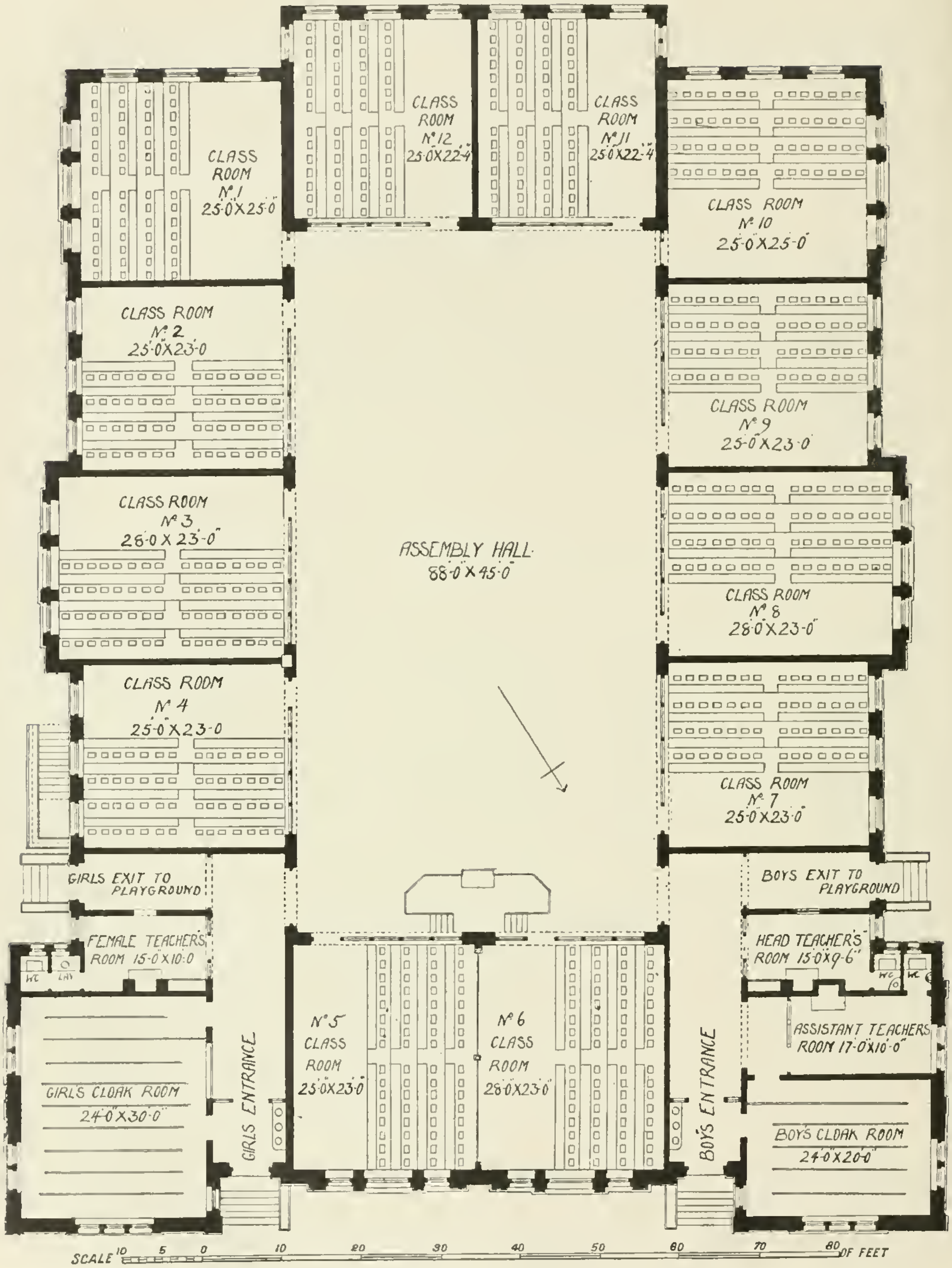
Headmaster, but beyond that there is no accommodation for the teaching staff. There are no less than seven entrances to the building, so that in cases of necessity it could be emptied very rapidly. The lavatory basins are arranged in these entrance porches. The warming and heating of the building is provided for by the method known as the Plenum system, which is referred to and described when discussing that form of ventilation.* The school cost about £18,000.



338. Infants' Department, Great Horton School, Bradford.

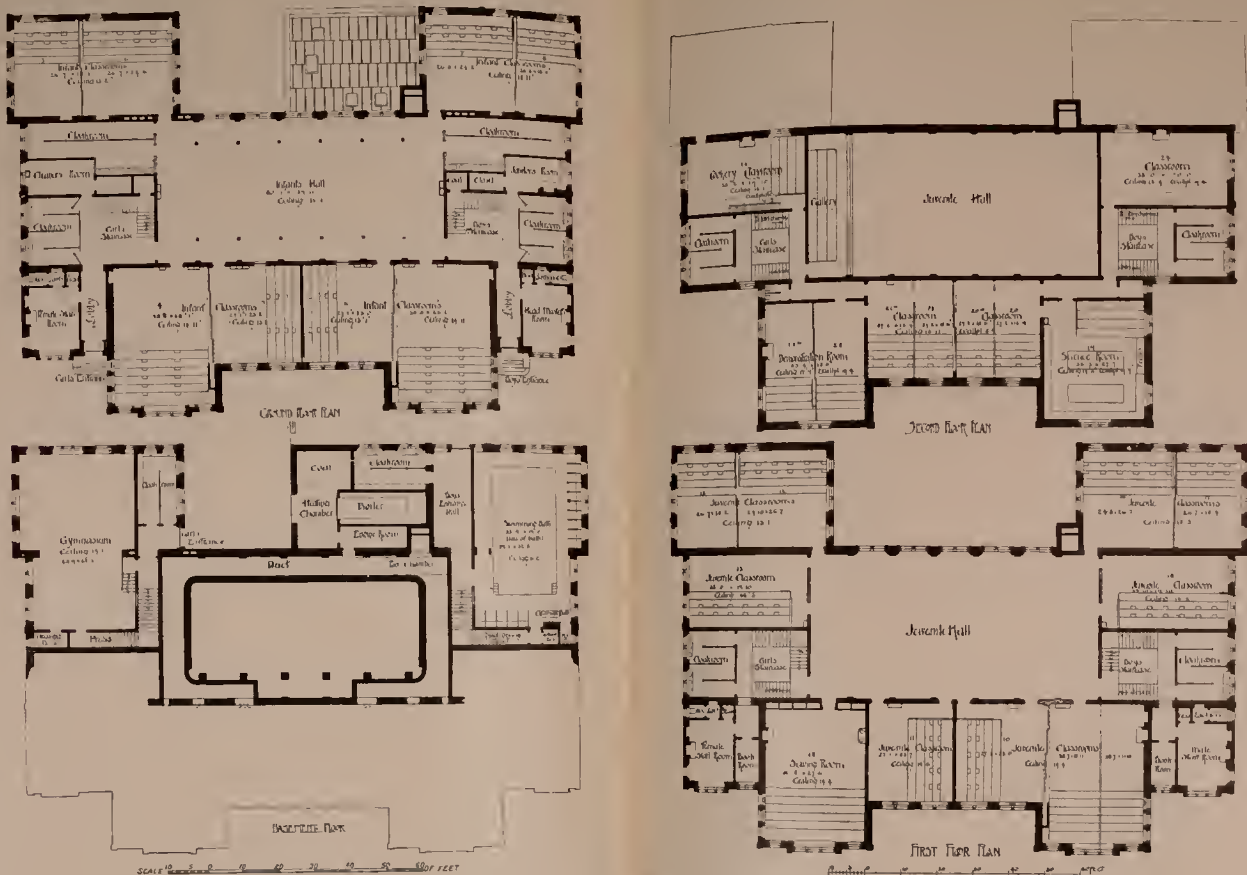
The Great Horton School, Bradford.—This is another example of a large one-storeyed building, with the Infant School arranged in a separate building (see Figs. 338, 339). The upper school is a "mixed" school, and provides accommodation for 704 children. The class-rooms, of two sizes, viz., 56 and

* See pages 452-5.



339. The Great Horton School, Bradford.

W. J. Morley, Architect.



340-343. THE BRUNTSFIELD SCHOOL, EDINBURGH.

The Edinburgh School Board. *Robert Wilson, Architect.*

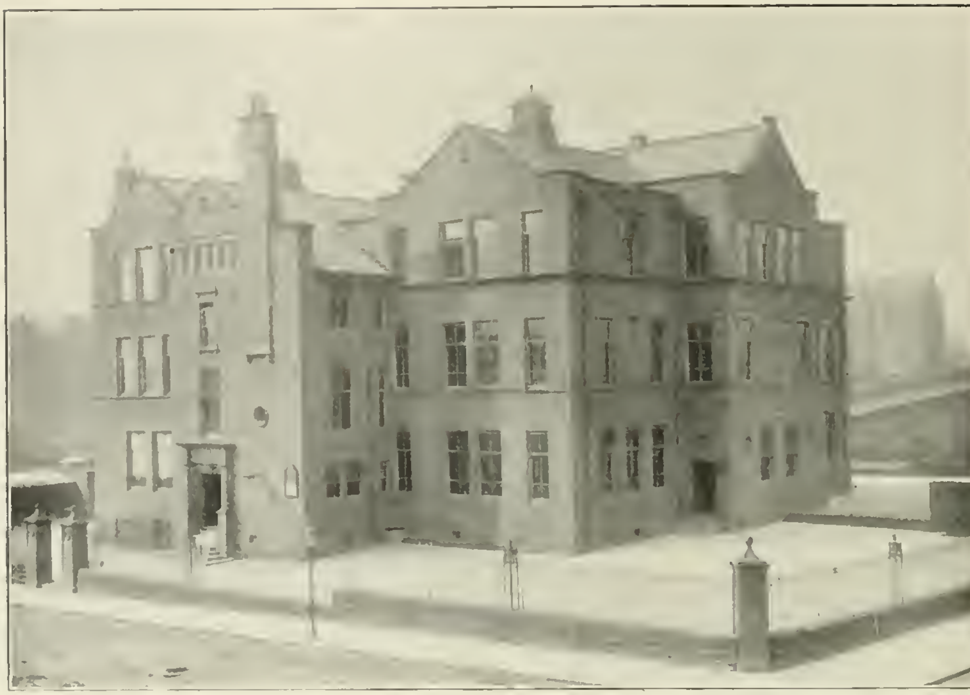
344-347. THE BROUGHTON ROAD SCHOOL, EDINBURGH.

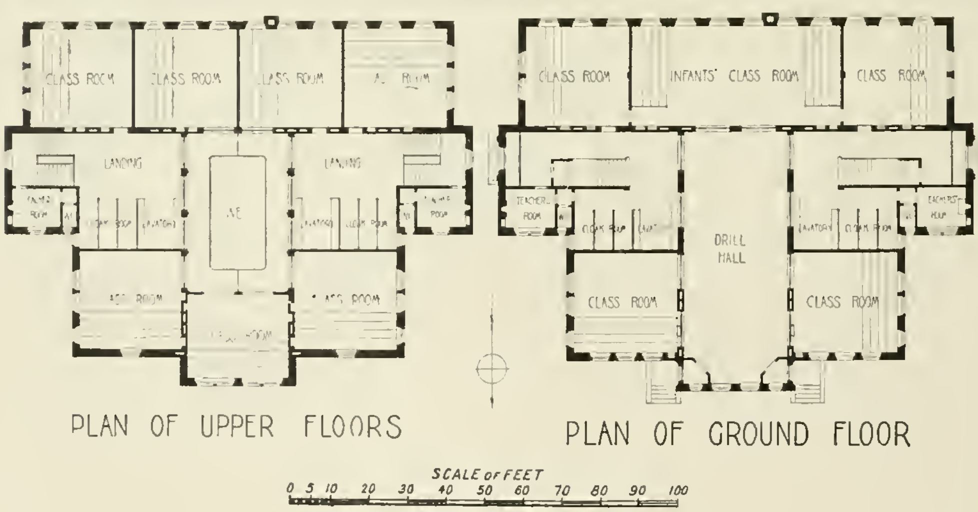
The Edinburgh School Board. *Robert Wilson, Architect.*

64, are arranged round a central hall, separated by glass partitions from the latter, which is of large size, measuring 88 by 45 ft. This allows rather over $5\frac{1}{2}$ sq. ft. per head. Fig. 338 shows the building for the Infants' Department.

Bruntsfield School, Edinburgh.—Figs. 340-343 show an example of a Scotch Board School. This building, recently erected in Edinburgh, has a novel feature, in a swimming-bath situated in the basement of the building, with a gymnasium to correspond with it on the opposite side. This plan for the swimming-bath was warmly spoken of by the teachers, but it appears not to have been adopted as a regular plan by the Edinburgh Board, though found again in the school illustrated below, probably owing to the expense involved. The ground floor is devoted to the Infant Department, for whom the hall on that floor is reserved. The rest of the school is mixed, and known as the "Juvenile" Department. They occupy the first floor, while the second floor is reserved for more advanced scholars, being practically a Higher Grade School to which pupils come from all over the neighbouring district. It will be noticed, on looking at the plan of the second floor, that the class-rooms on the front are separated by partitions in order to allow of the necessary division, while facilities are provided for the teaching of science, cookery, &c. The plan of the school is on the whole not unlike that of a London Board School, and provides good and ample accommodation both for the pupils and the staff. Unfortunately, the lighting in some of the class-rooms cannot be considered good. This was especially noticeable in the class-room at the south-east corner of the building next to the boys' entrance. This room, both on the ground and first floors, had been divided by a partition (see Fig. 341) into two long narrow rooms with the only light at the back, and, the school being very full, the seats were necessarily brought a considerable distance forward, with the consequence that about half the children were in a quite inadequate light. The difficulty had been partially met by introducing a side window high up in the case of the room on the first floor. It should be added that, were the seats arranged as shown by the architect, the light would be strong enough, but owing to the increase in numbers in the school it has been necessary to bring the seats much farther forward. The lighting, again, of the divided class-rooms on the top floor can hardly be considered to come up to modern requirements.

Broughton Road School, Edinburgh.—The school shown in Figs. 344-347, also an Edinburgh school, has swimming-bath and gymnasium in the basement; but in this case it is not provided with a hall, the class-rooms being grouped all round a central staircase, a





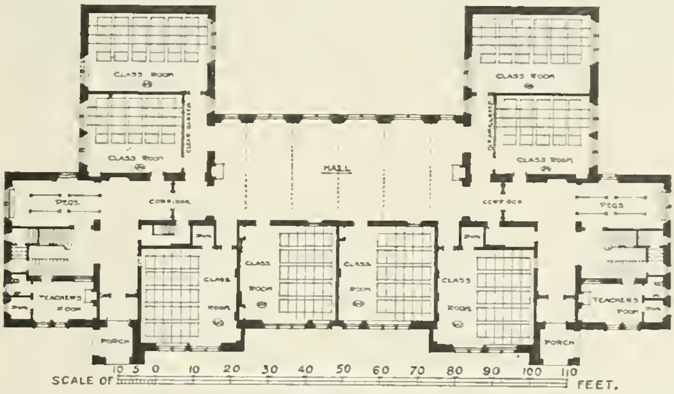
348-350. THE ALEXANDRA PARADE SCHOOL, GLASGOW.

The Glasgow School Board. *M'Whannell & Rogerson, Architects.*

science class-room and cookery instruction room being provided on the top floor.

Alexandra Parade School, Glasgow (Figs. 348-350).—The plans of this school were sent by the Glasgow School Board to the Paris Exhibition of 1900, as being a typical example of their Elementary Schools. As is usually the case in Scotch Schools, there is not a hall on each floor, access to the rooms on the upper floors being gained by means of a gallery. The cloak-rooms and lavatories are conveniently placed on the landings close to the stairs, accommodation for the teachers being arranged off the half-way landing.

Another Scotch school is shown in the Bathgate School, Fig. 351, designed by Mr J. Graham Fairley, and recently opened. The school



351. The Bathgate School.

J. Graham Fairley, Architect.

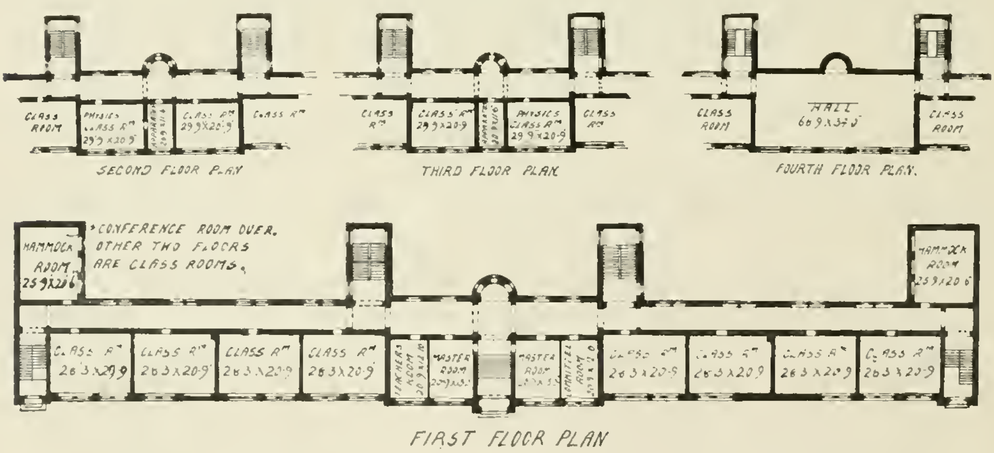
is intended to take 920 scholars. It has two halls, and cost about £13 a head.

All these schools of which plans and descriptions have here been given are typical of a very large number of schools that have been recently built all over the country. They are organised on what is called the "class-room" or "Prussian" system, and, as the idea of this arrangement was probably in the early days borrowed to a large extent from the Continent, it will be interesting to compare with them one or two of the more recent German Elementary Schools before passing to different types of buildings. In comparing the plans of the schools in the two countries, it should first of all be borne in mind that the hall in a German Elementary School corresponds in no degree to that found in our schools. It is there, if found at all, which is by no means always the case, placed on the top floor well out of the way. It is used for examination

purposes and social functions, and is often handsomely decorated. But while they have in Germany no assembly halls corresponding to ours, there is always attached to the school a spacious and well-equipped gymnasium, standing as a rule in the playground. The school very

352. Elementary School in the Christburgerstrasse, Berlin.

often assembles in this for prayers, singing, or work of a collective character. They usually include in their Elementary Schools special rooms for science teaching, if not completely equipped laboratories. They also have in the newer schools elaborate and complete washing



353-356. Elementary School in the Christburgerstrasse, Berlin.

and dressing rooms, fitted with spray and shower baths, generally placed in the basement. These will be found fully described on pages 464 *et seq.* In Germany, Infant Departments are not found as part of the school. The school age begins at six. Below that the State School does

not concern itself with children, though a number of private persons and societies are organising Kindergartens for children under six years of age. Class-rooms with sliding and movable partitions are not found in German Schools. It will be noticed that the German Schools are divided into two corresponding halves for the different sexes vertically, while in this country they are always divided horizontally so as to give a floor to each.

As an example of a large Public Elementary School are given the plans of a large school recently erected in the Christburgerstrasse, Berlin (Figs. 352-356). This is intended to take about 2,000 children. The building has four floors (on each of which the rooms exactly correspond, except in the centre of the building), besides a basement, and contains the following accommodation, arranged on the different floors as follows:—The class-rooms, of which there are thirty-eight, are all the same size, viz., about 28 ft. by 19 ft. 9 in. On the ground floor next the main entrance, which divides the school into the boys' side and the girls' side, the two halves corresponding in every particular, are placed two offices.

To the left of the office, on the left side of the entrance, is the Head Teacher's room, and corresponding to it on the other a map-room. Beyond this on each side are four class-rooms, and in the projecting wings on each side there are two rooms in which the youngest children are put during recreation hours, where they can play under supervision. These rooms are a recent innovation, and are called "Kinderhorte." On the first floor the room over the offices to the left of the entrance is a Natural Science class-room, while the space over the entrance is used as an apparatus-room, the remaining nine rooms along the front being class-rooms. In the two projecting wings are two conference-rooms, which serve as common rooms for the masters and mistresses respectively.

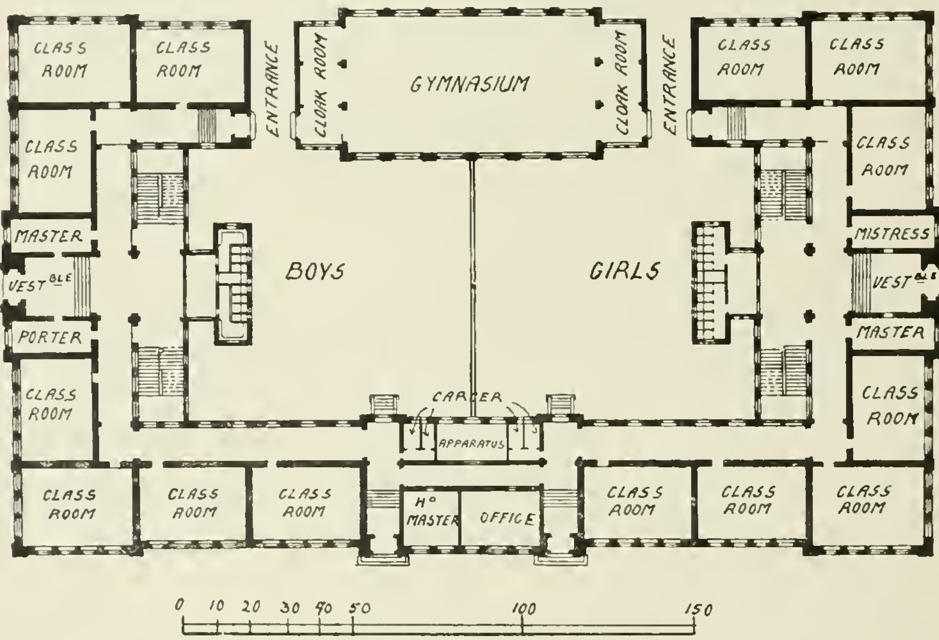
On the second floor the room to the right of the entrance is taken for Natural Science teaching, with the same arrangement for apparatus, the remaining eleven rooms serving as class-rooms.

On the third floor there are found ten class-rooms, while the three rooms in the centre are combined to form the hall.

In the basement there is a large provision for the storage of coal and the heating apparatus. Here is found also the spray-bath arrangements, consisting of two rooms, one serving as a dressing-room, with twenty compartments; in the other are arranged shower-baths. Next to it are two drying-rooms and the heating apparatus for the shower-baths. In the two projecting wings are two rooms where all the

cleaning apparatus, &c., is kept, and under the stairs in the small projections are found two closets for the masters and mistresses respectively. This list of accommodation omits the large gymnasium, which stands in the grounds at some little distance from the school. See Fig. 296, where a site plan of the school is given.

In considering the accommodation provided, it will be noticed that there is no cloak-room provision. Secondly, that though the teachers' rooms are on the first floor there is no provision of closets nearer than the basement, and no lavatories at all, either for teachers or scholars.



357. Large Elementary School, Mannheim.

Except for these points, the building is planned on a lavish scale as regards room. The corridor alone, running as it does the entire length of the building on four floors, with width of 9 ft., makes an area of 2,970 sq. ft., which would be equal to a hall of say 73 by 40 ft., or five more class-rooms.

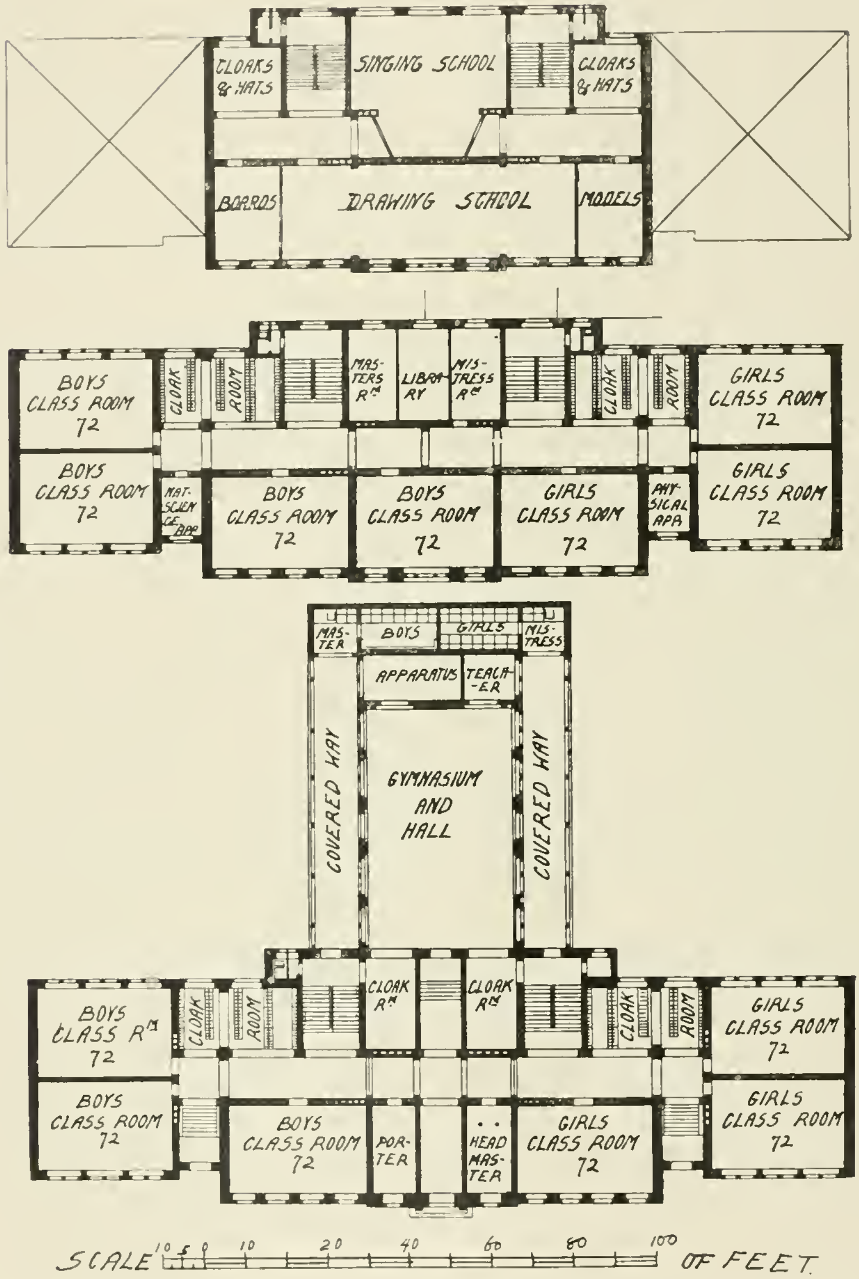
The plan of the building is simple in the extreme, consisting of merely one very long corridor with all the required rooms opening off it. On looking at the block plan (Fig. 296) it will be seen that all the class-rooms, with the exception of two on the third floor, look over the playground. This system of a long corridor with class-rooms

opening off it on one or both sides is one very commonly met with in German Schools.

The next example, taken from the "Handbuch der Architektur," shows another arrangement of the corridor system of planning, the building forming a square, so arranged as to include the gymnasium, which serves for both Boys' and Girls' Departments, as is very commonly the case, though in many of the large schools two are supplied, one for each department. This school (Fig. 357) is a large Elementary School at Mannheim, and contains seating accommodation for 2,100 scholars, for whom there are forty-two class-rooms, each capable of taking 50 scholars. The gymnasium is of considerable size, measuring 72 ft. by 39 ft. 3 in., having an entrance on each side of it with cloak-rooms. This building was erected in 1887, the architect being Ritter. The school has four carcera or punishment cells, two for each department. These are not apparently used much, and are generally omitted in the more recent schools.

The next example (Figs. 358-360), drawn from a work by H. Reinold Faber, shows a different type of school. In this case the gymnasium is included in the building, instead of standing away from the main block in the playground—in fact, German School plans may be roughly divided into those in which the gymnasium is separate and those in which it is included in the main building. The inclusion of the gymnasium does not prevent the aula or examination hall being also provided in the accommodation. It is not usual to carry the gymnasium above the first floor. This example presents considerable difference to the foregoing building, and in general plan and arrangement bears more resemblance to an English Secondary School. The accommodation is ample and conveniently arranged. This school has, in addition to the rooms given in the building above, a library, serving when required for a conference-room, placed next to the masters' and mistresses' common rooms. There are lavatories for both masters and mistresses on each floor off the landings and the stairs. There is also ample cloak-room accommodation. There is no examination hall to this school, the gymnasium answering here both purposes. On the top floor there is a large drawing-school and a singing-room. The latrines are placed at the end of the gymnasium, away from the school building, with which they are connected by two covered ways, one on each side, corresponding to the division of the building into the Girls' and Boys' Departments.

There is seating room in the class-rooms for 936 children, each class-room being capable of taking 72 pupils.



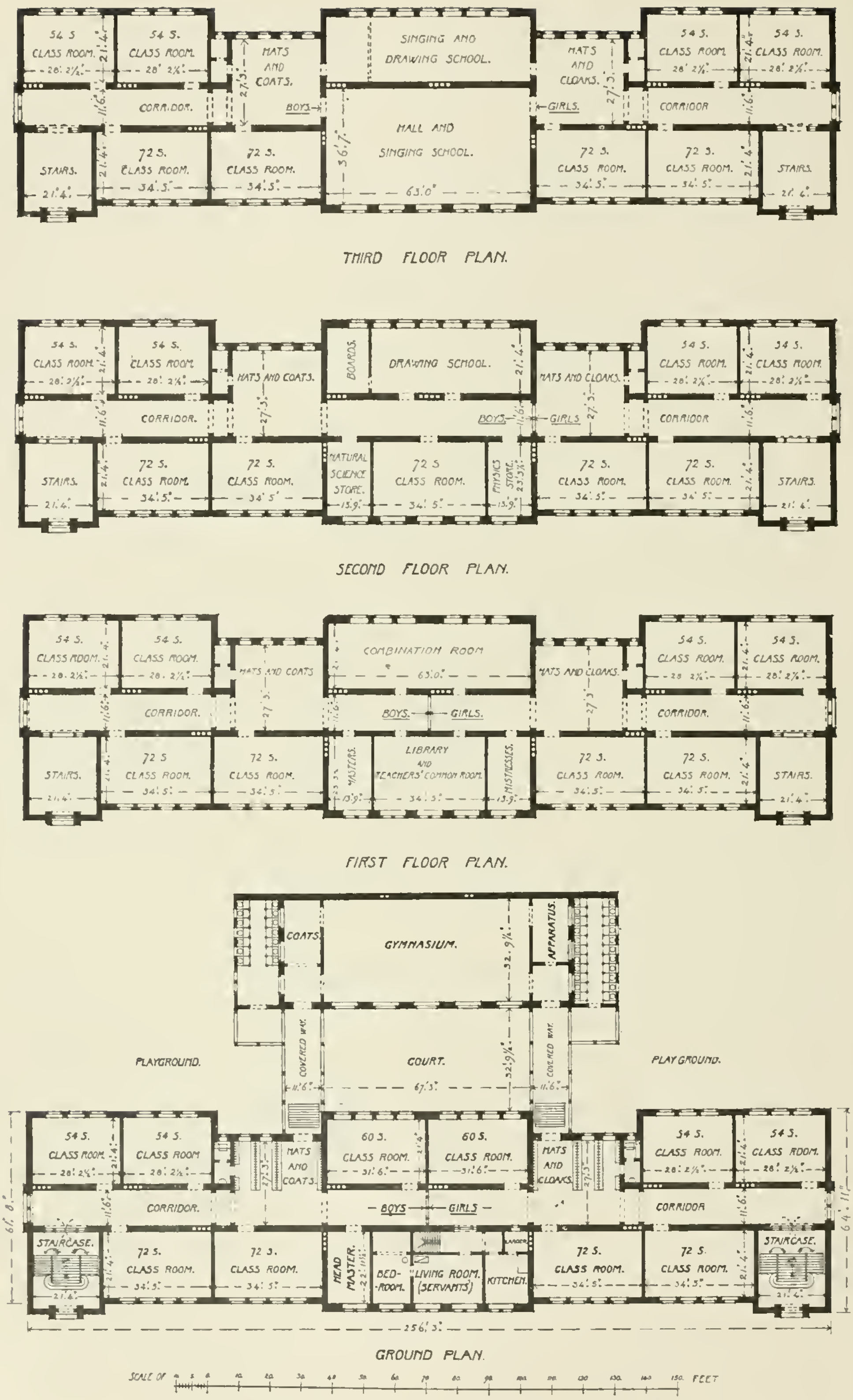
358-360. A German Town School.

Reinold Faber, Architect.

The main entrance of the building leads straight through the handsome vestibule down some steps to the gymnasium. On either side of this are found the Headmaster's room and the office. The pupils' entrances lead directly to the cloak-rooms, which have two entrances on to the corridor down the centre of the building. This corridor obtains its light through the cloak-rooms and from the windows on the stairs. The cloak-rooms are of considerable size, each of them measuring about 27 by 15 ft., and are repeated on the first floor, and on rather a smaller scale on the second floor. At the end of the gymnasium is provided a room for the teacher and another for the apparatus. In the basement are found the caretaker's living-rooms, heating apparatus, and coal cellars, also storage-room for chairs. On the first floor the space over the entrance in each department is utilised to form a small store-room for keeping the apparatus used in teaching Natural Science. On the whole it is a carefully thought-out and well-arranged school, and, except that there are no washing arrangements for the pupils, it is difficult to find anything that has not been provided for.

The next example (Figs. 361-364) shows a somewhat similar arrangement of school, but on a much larger scale. There is accommodation for over 2,000 scholars, the class-rooms being of two sizes, for 72 and 54. The gymnasium in this case is not included in the main block of the building, but lies a little way off, and is connected with it by two covered ways. There is again in this school ample cloak-room accommodation, and the assistant masters and mistresses are well provided for. The accommodation is on a large scale. There is a room for teaching Natural Science with its store-rooms, a large hall measuring 63 by 36 ft., drawing-school, singing-room, and a combination room to serve a variety of purposes. We have hardly reached the point in this country where so elaborate and completely equipped a building, designed on such spacious principles, could be supplied for an Elementary School.

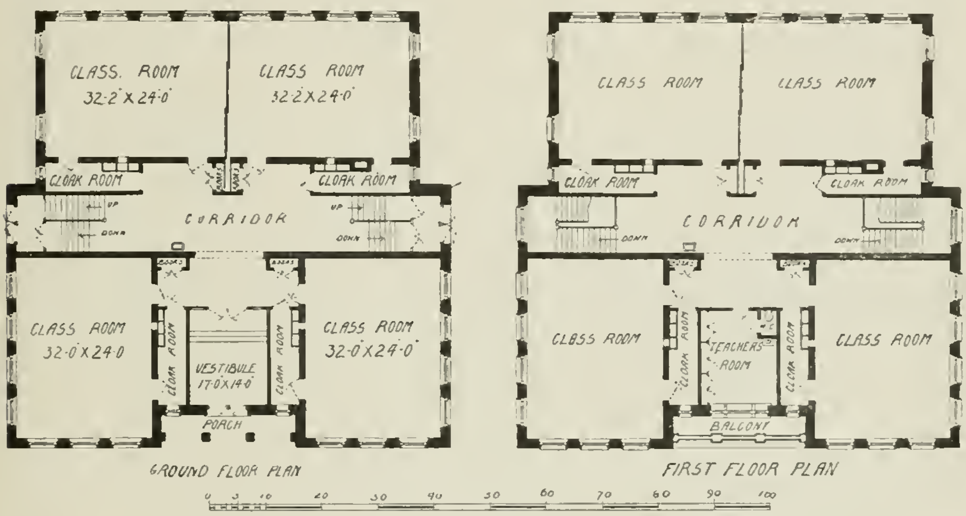
I have endeavoured in these plates to compare the ordinary types of the more modern development of school planning in the two countries, the schools in all the cases selected being organised on the same principles, viz., that of separate class-room teaching. And while the English Schools are admirable examples of compact and ingenious planning, and fulfil all the requirements which sanitary science can demand in regard to ventilation and light for the pupils taught in them, they are most carefully arranged in every way to be as economical as possible, and every feature that cannot be proved to be actually



361-364. A Large Elementary School, Germany.

Reinold Faber, Architect.

essential for the educational or sanitary needs of the pupils is rigorously cut off. But although public opinion in this country will not tolerate an expenditure on the school which can in the smallest degree be considered unnecessary, it is equally determined now that our children shall be taught in buildings that are as hygienically good as they can be made. On the other hand, in Germany money is apparently much more easily forthcoming for school purposes, and the buildings seem planned with what appears to be an almost complete disregard for expenditure. Any feature or room that seems to offer a chance of advancing the efficiency of the school is at once included, regardless of the cost.



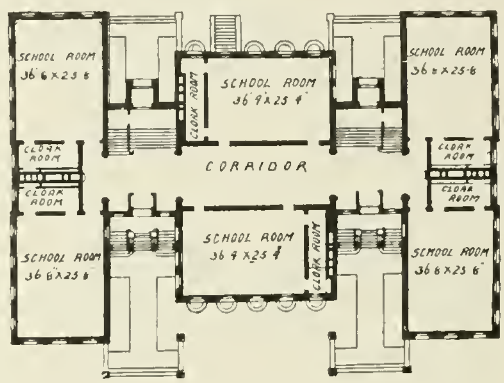
365, 366. PUBLIC SCHOOL, LONGSHORE STREET, PHILADELPHIA.

America.—The American Schools for elementary teaching comprise Grammar and Primary Schools. These are almost always in the same building, and correspond roughly to the Infant Department and older department of the Elementary Schools of this country, Massachusetts being the only State which supplies separate buildings for the Grammar and Primary Grades. No Master's office is found in the Primary Schools. The Head of the Grammar is also the Headmaster of the Primary Schools of his district. Primary Schools are always mixed, the Grammar usually so.

A class-room to hold 56 pupils* measures, as a rule, in the Primary

* American School Architecture, E. M. Wheelwright.

Schools, 32 by 24 ft., and in the Grammar 32 by 28 ft., giving nearly 14 sq. ft. per head in the first case, and 16 sq. ft. in the second, considerably more than is considered necessary in England. Each class-room has a separate cloak-room attached to it, with if possible an outside light, and one or both entrances to it from the class-room. Sometimes the hall is used for the purpose of a cloak-room by means of partitions.* A common method of planning in America is that of a square building with large class-rooms arranged at the corners, and so lighted on two sides, leaving the centre of the building for the hall and cloak-rooms (see Figs. 365, 366), American architects being seldom satisfied with one wall only from which to procure light. This is, however, usually rendered necessary by the great size of their school-rooms. See for example Fig. 367, showing the first-floor plan of Auburndale School, Ohio, which consists of six rooms measuring over 36 ft. 8 in. by 25 ft. 8 in., and all of them arranged so as to obtain light on more than one side. This plan shows the cloak-rooms with entrance only from the class-room.



FIRST FLOOR PLAN

367. Auburndale School, Toledo, Ohio.

The toilet-rooms, W.C., &c., are not, in American Schools, located in a separate building, but are placed generally in the basement, where there is also, as a rule, a large play-room for both boys and girls. As an example of a large Elementary School there are given in Figs. 368-370 the plans of the Fowler School, Cleveland, Ohio.

The basement (Fig. 368) is entirely given up, as far as the pupils are concerned, to play-rooms and lavatories. The large amount of space devoted to the heating and ventilation, which occupies the remainder of the space, should be noticed. The arrangements of the air ducts and smoke flues are indicated on the plans. The sanitary blocks are so placed that they do not, as is so often the case in American Schools, come actually under the main block of the building. The boys' half of the play-rooms is divided from that of the girls' merely by an open-work railing called a "picket fence," each having their own staircase.

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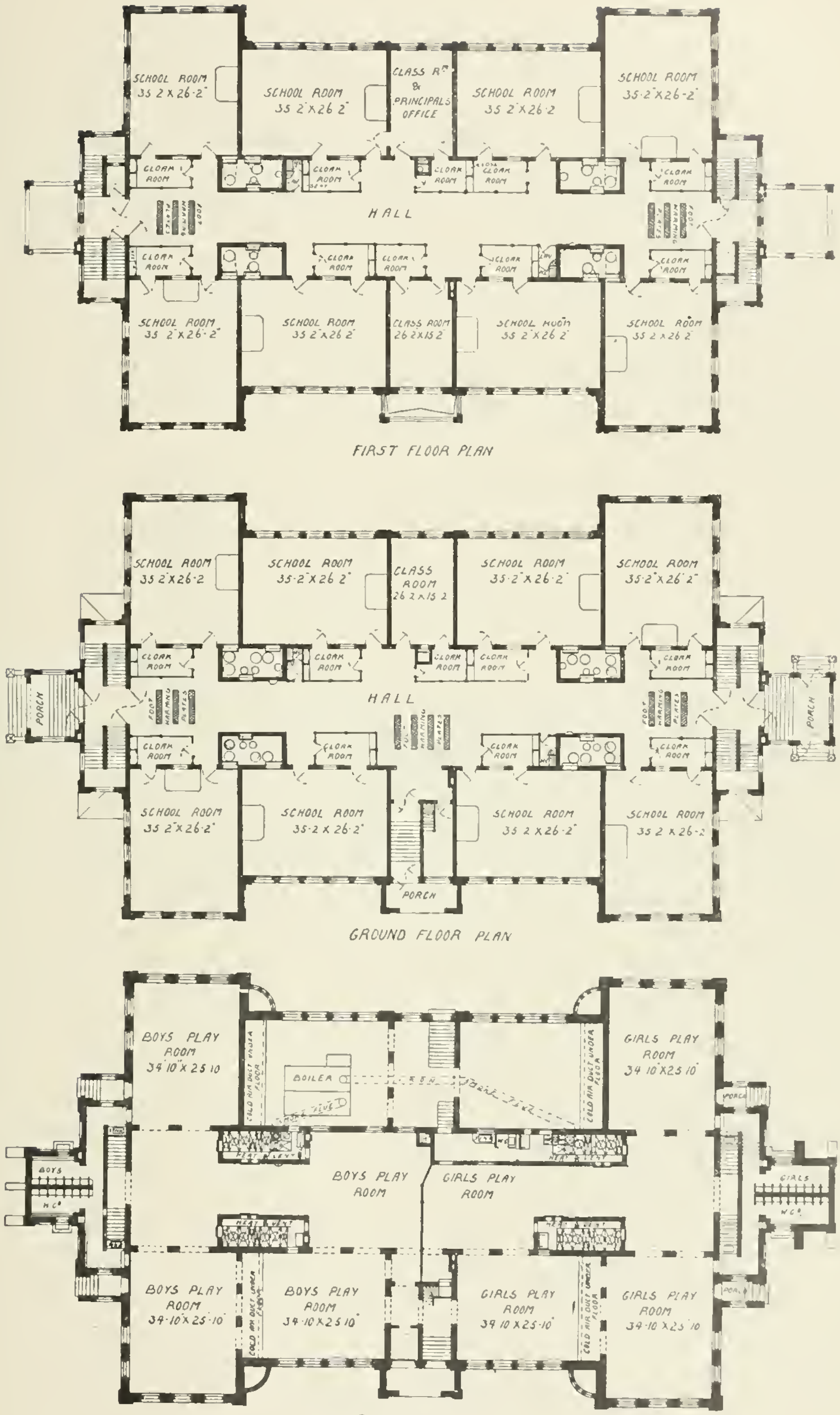
* See page 130, Cloak-room.

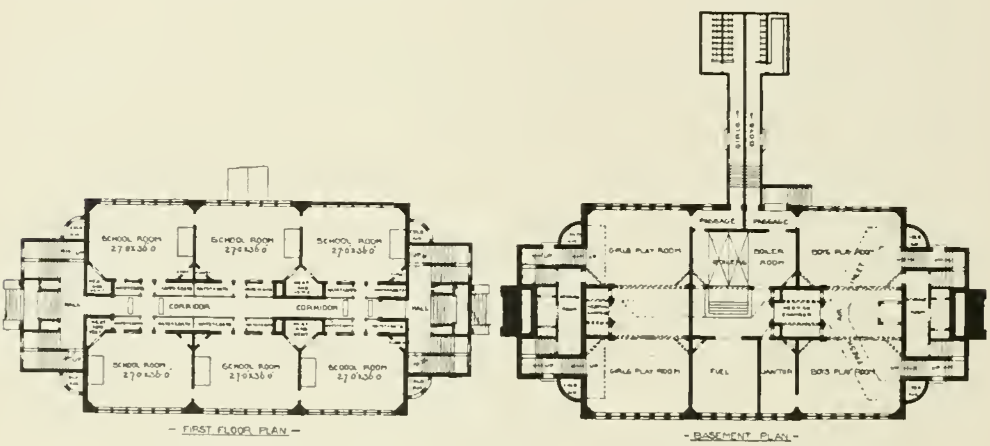


368-370. The Fowler School-house, Cleveland, Ohio.

Palliser & Palliser, Architects.

On the ground and first floors are placed the class-rooms. It will be noticed that most of the rooms are of large size, some 36 by 25 ft., and are called school-rooms, while three smaller rooms are provided marked class-rooms. It should be remembered that most of the actual oral teaching is done in these smaller rooms, more often known as "recitation" rooms.*

In the centre of the building is a wide corridor called the main hall, but the available space left after deducting the cloak-rooms, of which there is one to each school-room, is not large enough to answer the purposes for which a central hall is considered necessary in this country. Another feature that would probably be considered objectionable here are the closets placed in some of the cloak-rooms, and so



371, 372. The Bridgeport School, U.S.A.

Warren Briggs, Architect.

in the centre of the building. They are of course placed against the large ventilating shafts, and are so probably quite safe as long as the ventilation is working efficiently. The hall is lit by borrowed light from windows placed over the cloak-rooms. The foot-warming gratings should be noticed.

The building is spacious and conveniently planned. The school-rooms, though far too large † for our methods of work, are excellently lighted, while lavish provision has been made to ensure their efficient warming and ventilation.

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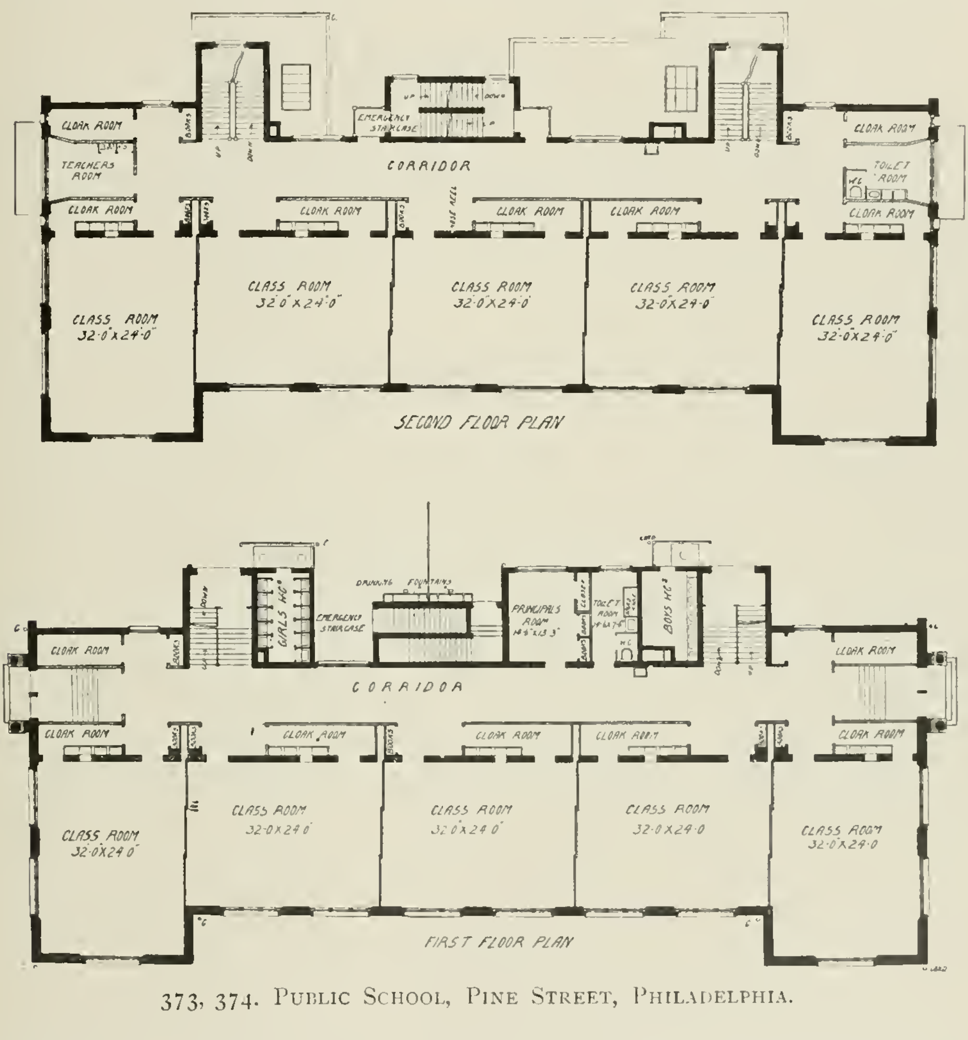
* See page 28.

† The school-rooms would take 90 children on the basis of the Regulations of the Board of Education.

Figs. 371, 372 show the floors of the Bridgeport School. The sanitary block is placed in this case outside the building.

Figs. 373, 374 show an American school arranged simply as a corridor, with the class-rooms opening off it. It will be noticed that the sliding partitions are so arranged that all the class-rooms on each floor can be at once thrown into one room running the entire length of the



373, 374. Public School, Pine Street, Philadelphia.

building. A hollow place is provided between the cloak-rooms into which the partitions can be run, so that the whole of the partition can be taken away. As there is no other division between the class-rooms except these movable partitions, it is difficult to see how disturbance caused by movement in an adjacent room is to be avoided. An emergency stair from the first floor is here provided.

In order to show generally the main lines upon which Elementary Schools are at the present time planned in the more important countries on the Continent, there are subjoined a series of figures giving typical plans of schools from twelve countries. These figures are taken from an interesting series of articles by Professor Carl Hinträger,* published last year in *Das Schulhaus*, a German magazine devoted to school building. The most marked difference between the schools of this country and those on the Continent lies probably in the use of the hall. The arrangement so common as to be almost universal in this country of a central hall used for collecting the school, off which the class-rooms open, is, practically speaking, not found on the Continent. It is true that many of the schools are provided with a large hall, but this is either used for social functions, annual semi-public examinations, and so on, or is simply a gymnasium, which, even when included in the main building, as for example, in the school from Finland (Fig. 377 (10)), is treated without reference to the position of the class-rooms. In the schools where a hall is provided it is very often treated with considerable attempt at architectural effect, but usually placed well out of the way on the top floor. A suitably fitted gymnasium is all over the Continent looked upon as an indispensable adjunct to every school except the very small country schools. A method of planning that is found very frequently in the Scandinavian and Danish Schools should be mentioned, in which an ante-room is formed at the top of the stairs, which forms at the same time a cloak-room, and the access to a number of class-rooms. An example of this can be seen in Fig. 377 (11). Great ingenuity is sometimes shown in arranging a large number of rooms so that they can all be entered from one entrance cloak-room. This plan would be objected to in this country, where it is considered undesirable for class-rooms to be entered directly out of a cloak-room. The arrangement is made somewhat easier by the custom, almost always found on the Continent, of dividing the schools for the two sexes vertically instead of by floors, as it is thus possible to put four class-rooms back to back in the centre of the building (see Fig. 377 (3)).

It will be noticed that, except in the case of America, a teacher's house is always provided as part of the school block, either actually forming part of the building or standing in its immediate neighbourhood. The provision of sufficient light from the right direction is always carefully provided. A covered playground is usually provided in France, and even in the smallest schools it is rarely absent.

* Grundriss-Typen neuzeitlicher Volksschulhäuser von verschiedenen Ländern.

The more modern schools are usually supplied with cloak-rooms, which, as will be seen on referring to the examples, are of considerable size, and are arranged as an entrance to the school-rooms, no objection being felt to their use as passages, as was for a long time the case in this country. These large cloak-rooms also serve as rooms in which children who come from a distance can eat the dinners they bring with them. In America separate cloak-rooms to each class-room are usually found.

The offices were in the older buildings, and still are to some extent placed against or inside the main building; however, the tendency now is to place them as in this country out in the playground, connecting them, however, in many cases by a covered way with the main building.

The most remarkable example of position of offices is that shown in Fig. 375 (7), from Holland, where the offices open directly off the corridor, and all other considerations have apparently been superseded by a desire for thorough supervision. The unsatisfactory nature of this arrangement is accentuated by the fact that the school is mixed.

In Scandinavia, where the population is so scattered that a regular attendance at schools would be impossible, there is a special form of school (see Fig. 378). This has a sleeping-room for boys and girls, each taking five. The school is opened for two or three months in the year by a travelling teacher, and the children who live too far to get there and back in the day are boarded in the school, during the course for which the school is open, either paying a small sum or free. In some cases a dormitory is attached to the teacher's house.

378. A Swedish Seasonal School.

1. Sleeping-room for 5 Boys. 2. School-room. 3. Cloak-room for Boys. 4. Teacher's Room. 5. Cloak-room for Girls. 6. Sleeping-room for 5 Girls.

The Continental Schools are usually provided with complete appliances for giving all the children shower-baths. These will be found fully described in the chapter on sanitation; they have also as a rule a dining-room and kitchen for the children.

The floor space provided per head is much the same as in this country, except in the case of the newer American Schools, where it is not uncommon to find a considerably large allowance of area per head. To this is due the large size of the class-rooms in American Schools, which combine the large numbers of an elementary class, with an

allowance of floor space and single desks, which are usually only provided here for the relatively small classes of Secondary Schools.

A further noticeable point in American Schools is the large provision of ventilating ducts, and arrangements for the provision of fresh air and warming. Some of these systems have been adopted in this country, but not often on so lavish a scale, nor is there anything like the same provision for this made as is the usual custom in the United States. The more rigorous climate of that country, and the much greater range of temperature to be provided for, no doubt account for this to a large extent. The school gardens and decorative treatment of the playground, which form a feature of Continental Schools in Northern Europe, are found neither in England nor America.

General Description of the Elementary Schools in the Twelve Countries Selected for Illustration.—See Figs. 375-377.

America.

Small Schools, 375 (1).—Teacher's residence never in the school building. Separate entrances and cloak-rooms for boys and girls. Generally a small room for teachers, and store for coal and wood. Sanitary conveniences well away in the corners of the playground. School-room lit from one side.

Medium-sized Schools, 376 (1).—Usually on two floors. School-rooms lit from three sides. A separate cloak-room to each class-room. Offices outside the building, but connected by a covered way. Large playgrounds for each sex. School gardens.

Large Schools, 377 (1).—Class-rooms opening off a wide central corridor forming a hall. Separate cloak-rooms attached to each class-room. Offices in basement.

Belgium.

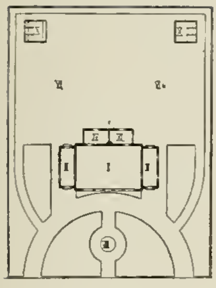
Small Country Schools, 375 (2).—Teacher's residence in separate building close to the school. School-rooms lit from two sides, left and right. Separate entrance porches for boys and girls, which also serve the purpose of cloak-rooms and lavatories. Separate open and covered playgrounds, the latter usually containing the offices.

Medium-sized Schools, 376 (2).—Boys' and girls' school separated by teacher's house. Class-rooms on two floors. Cloak-rooms off the stair landings. Open and covered playgrounds. School gardens. Offices in the playgrounds.

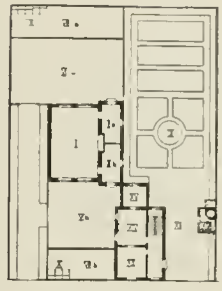
Large Schools, 377 (2).—This example has a central court covered with a glass roof. Boys and girls separated by floors. Offices outside the building, but connected by a covered way. Manual training room in basement. Gymnasium. Art-room. Needlework-room for girls. Separate rooms for masters and mistresses.

Denmark.

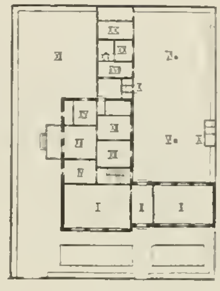
Small Country Schools, 375 (3).—Teacher's residence built immediately against the school. Cloak-rooms usually of considerable size, and common to both sexes. Manual training, a Slöjd-room, and gymnasium usually provided. Offices out in the playground. Class rooms lit from one side.



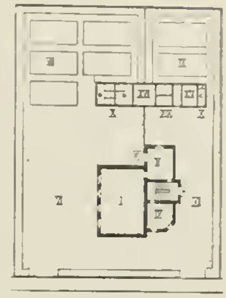
1. America.



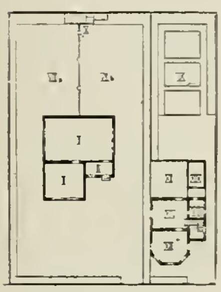
2. Belgium.



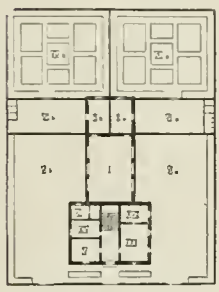
3. Denmark.



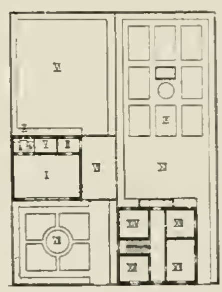
4. Germany.



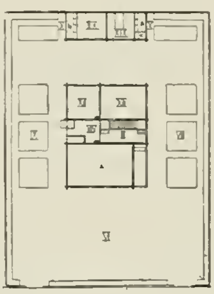
5. England.



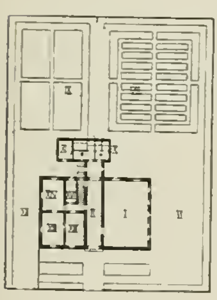
6. France.



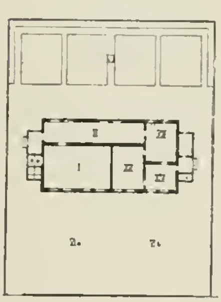
7. Holland.



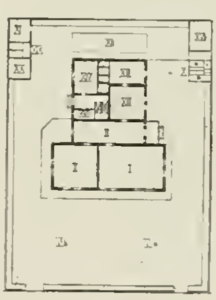
8. Norway.



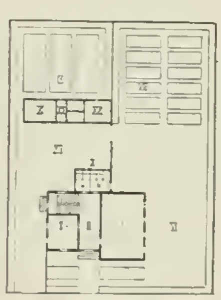
9. Austria.



10. Finland.



11. Sweden.

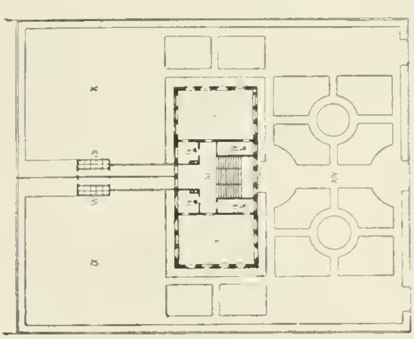


12. Switzerland.

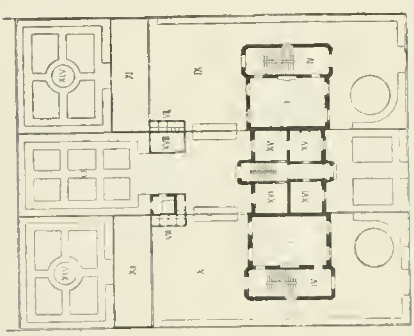
I. Class-rooms. II. Manual training rooms. III. Cloak-rooms. IV. Teachers' rooms. V. Stock-rooms. VI. Playground. VII. Covered playsheds. VIII. School gardens. IX. Teachers' gardens. X. Sanitary conveniences. XI. Fuel store. XII.-XVIII. Teachers' residence. XIX.-XXI. Stables.

375. Comparative Examples of Small Schools from Twelve Countries.

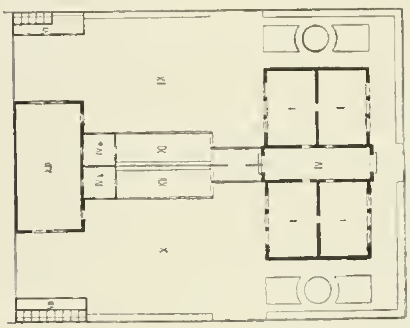
From "Das Schulhaus," 1905.



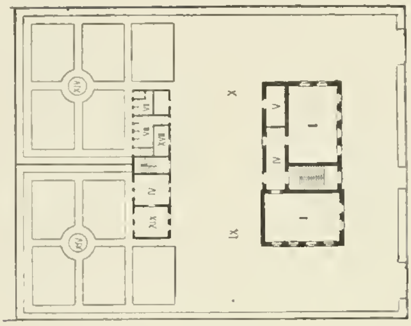
1. America.



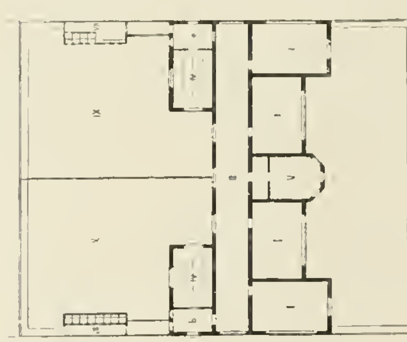
2. Belgium.



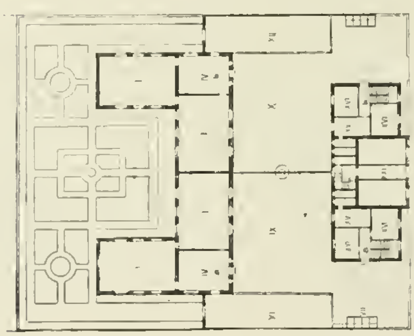
3. Denmark.



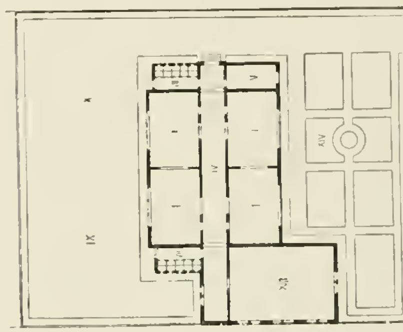
4. Germany.



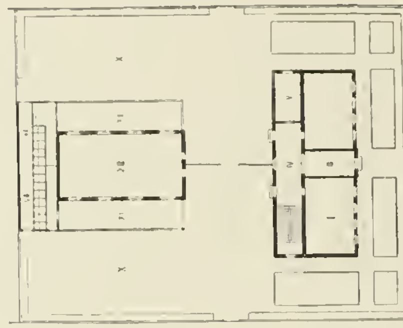
5. England.



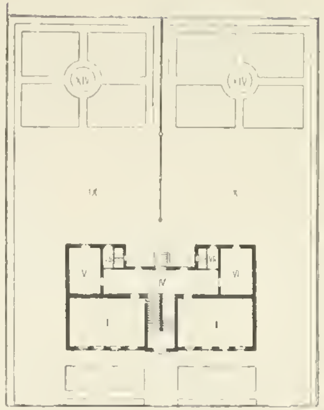
6. France.



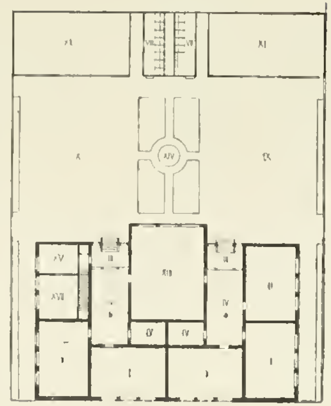
7. Holland.



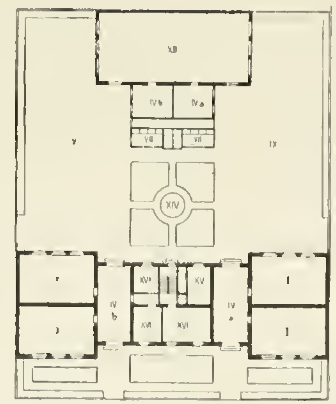
8. Norway.



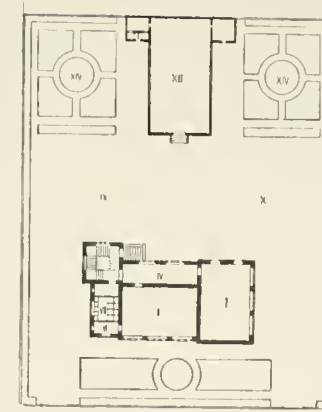
9. Austria.



10. Finland.



11. Sweden.



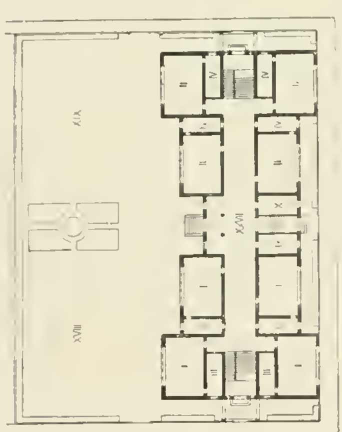
12. Switzerland.

EXPLANATION OF FIGURES.

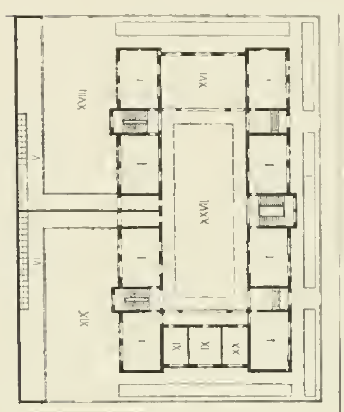
I. Class-rooms.
II. Manual training or *slöjd* rooms.
III. Entrance.
IV. Cloak-rooms.
V. Teachers' room.
VI. Store-room for teachers' apparatus.
VII. Boys' offices.
VIII. Girls' offices.
IX. Boys' playground.
X. Girls' playground.
XI. Covered playground for boys.
XII. Covered playground for girls.
XIII. Gymnasium.
XIV. School garden.
XV. Teacher's house.
XVI. Do.
XVII. School-keeper's living-room.
XVIII. Coal and wood store.
XIX. School bath.
XX. Teachers' garden.
XXI. Office.

376. COMPARATIVE EXAMPLES OF MEDIUM-SIZED (FOUR CLASS-ROOM) SCHOOLS OF TWELVE COUNTRIES.

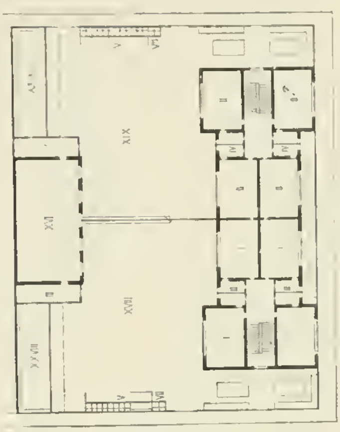
From "Das Schulhaus," 1905.



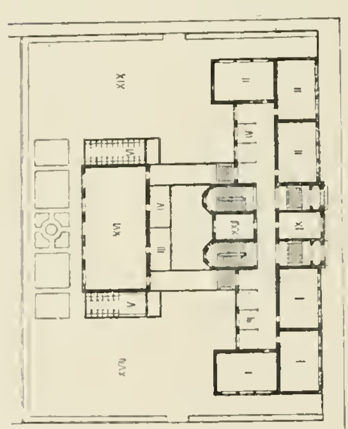
1. America.



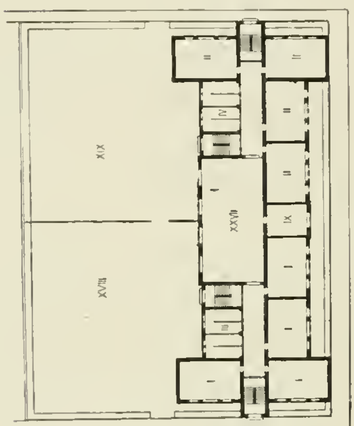
2. Belgium.



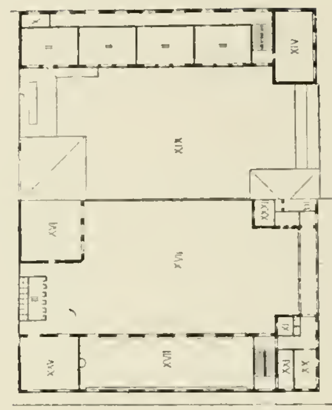
3. Denmark.



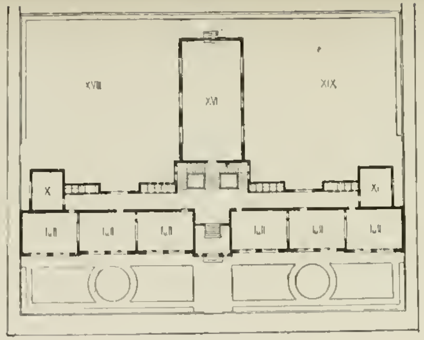
4. Germany.



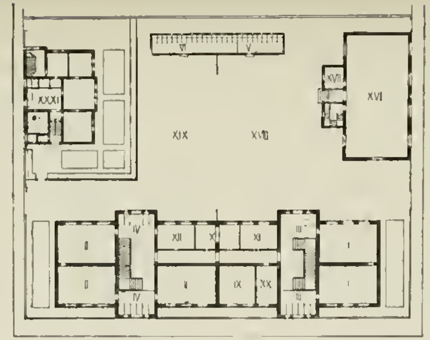
5. England.



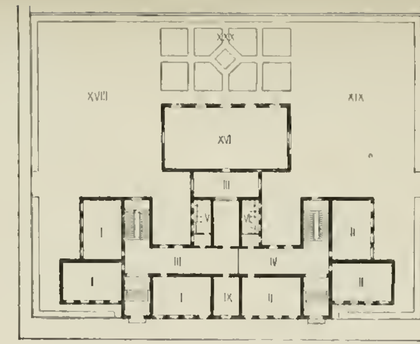
6. France.



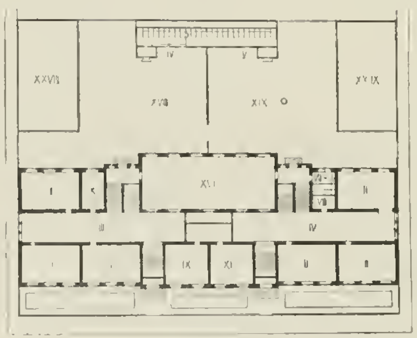
7. Holland.



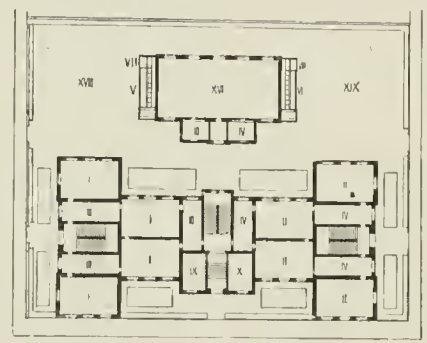
8. Norway.



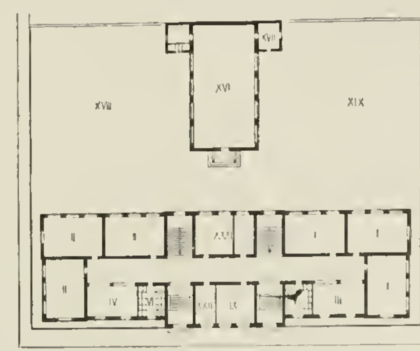
9. Austria



10. Finland.



11. Sweden.



12. Switzerland.

EXPLANATION OF FIGURES.

I. Boys' class-rooms.
II. Girls' class-rooms.
III. Boys' cloak-rooms.
IV. Girls' cloak-rooms.
V. Boys' offices.
VI. Girls' offices.
VII. Offices for Masters.
VIII. Offices for Mistresses.
IX. Room for staff.
X. Store-room for teaching apparatus.
XI. Room for Masters.
XII. Room for Mistresses.
XIII. Drawing school-room.
XIV. Manual training-room for girls.
XV. Manual training-room for boys.
XVI. Gymnasium-room.
XVII. Gymnastic apparatus.
XVIII. Boys' playground.
XIX. Girls' playground.
XX. Common-room.
XXI. Waiting-room.
XXII. School servants.
XXIII. School baths.
XXIV. Library.
XXV. School kitchen.
XXVI. Dining-room.
XXVII. Assembly hall.
XXVIII. Covered playground (boys).
XXIX. Covered playground (girls).
XXX. School garden.
XXXI. Rooms for school servants.

377. COMPARATIVE EXAMPLES OF LARGE ELEMENTARY SCHOOLS FROM TWELVE COUNTRIES.

From "Das Schulhaus," 1905.

Medium-sized Schools, 376 (3).—One-storeyed building. Common cloak-room in centre of building. Separate open and covered playground for each sex. Gymnasium with two cloak-rooms. Offices in the playground.

Large Schools, 377 (3).—Three-storeyed building divided vertically into two halves for boys and girls. Small cloak-rooms near the class-rooms. Gymnasium in separate building. Offices in the playgrounds. Open and covered playground for boys and girls. Baths, kitchen, and dining-room in basement. Teachers' rooms. Store-rooms. Studio. Manual training and needlework rooms.

Germany.

Small Country Schools, 375 (4).—Teacher's residence commonly over the school. Large cloak-room common to both sexes. School-room lighted from one side. Offices away from school in playground.

Medium-sized Schools, 376 (4).—Two-storeyed building. Cloak-rooms arranged as entrance to class-rooms. Rooms lit from left and back. Open undivided playground. Offices arranged in out-buildings.

Large Schools, 377 (4).—Three floors and basement, divided vertically for the two sexes, each of whom have their own entrances, staircases, and class-rooms. Cloaks usually hung in the corridors, more seldom in special cloak-rooms. Offices outside the building, but connected by covered way. Gymnasium in separate building in playground. In basement school-baths and dressing-rooms, kitchen and dining-room. Playgrounds for boys and girls. Separate rooms for masters and mistresses, and store-rooms. Drawing school. Manual training and needlework room.

England.

Small Country Schools, 375 (5).—Teacher's residence separate, but close by. In case of very small schools a common entrance may be found, serving also as cloak-room ; more usually there will be two separate entrances. School-room lit from two sides. Separate room provided for infants in all except the very small schools. Offices well away in separated playgrounds. A common playground will be found in very small schools.

Medium-sized Schools, 376 (5). One-storeyed building. Separate entrances and large cloak-rooms for each sex. Wide corridor used for physical exercises. Teachers' room. Offices in playground. Large separate playgrounds.

Large Schools, 377 (5).—Sexes separated by floors. Central hall for each department. Large cloak-rooms placed conveniently at entrances. Two staircases for each department. Offices away from building in playground. Teachers' room. Manual training and cookery rooms usually in separate buildings. Playgrounds and covered playgrounds for each sex.

France.

Small Schools, 375 (6).—Teacher's residence forms part of school block. School-room lit on both of the long sides. Separate entrances, cloak-rooms, and covered playgrounds containing the offices are provided for the two sexes. School gardens commonly provided.

Medium-sized Schools, 376 (6).—In this example of a town school there is a building in front, which, besides providing residential accommodation for the master and mistress, has various offices for the use of certain of the town officials. The school is divided into two similar halves for girls and boys, each side containing two class-rooms, cloak-rooms, and lavatory, a covered play-room, offices in an open playground, and a school garden.

Large Schools, 377 (6).—Separate buildings for boys and girls. Teaching-rooms on the two upper floors looking over playground. On the ground floor a larger room for physical exercise, with cloak-rooms, lavatories, &c. Gymnasium in separate building, combined with room for the school-keeper. Offices in playground. Teachers' rooms and store-room. Manual training and needlework room.

Holland.

Small Country Schools, 375 (7).—Teacher's residence in separate building. School-room lit from one side. Small common cloak-room and entrance. Covered playground. Offices approached directly out of the school-room.

Medium-sized Schools, 376 (7).—One-storeyed building, top-lighted corridor. Cloak-rooms in passage. Room for Head Teacher. Hall for physical exercises. Offices in the building. Two open playgrounds and school gardens.

Large Schools, 377 (7).—Boys and girls taught together in mixed classes. Often only one main staircase provided. The class-rooms where they come together are separated by glass partitions with doors, in order to facilitate supervision by the Head Teacher. The offices open immediately off the corridor with no separating lobby, to be well under the observation of the teachers. Cloaks hung in the corridor. Hall for gymnastic and physical exercise. School baths in basement. Teachers' rooms and store-rooms. Drawing school. Manual training rooms.

Norway.

Small Schools, 375 (8).—Schools commonly built of wood. Teacher's residence and school under same roof. Common entrance. Staircase used as cloak-room. School-room lit from one side. A manual training or Slöjd room is usually provided; in the example it is over the school-room. Offices out in the yard at the back.

Medium-sized Schools, 376 (8).—Two-storeyed buildings. Cloak-rooms in passage. Teachers' room and store-room. Hall for gymnastic exercise. Covered playgrounds. Open playgrounds. Offices arranged behind the hall.

Large Schools, 377 (8).—Three floors and basement. Building divided into two halves for boys and girls, each with separate entrance, staircase, &c. Cloak-rooms off the landings. Gymnasium in separate building. Separate building in playground for school-keeper's house. Playgrounds for boys and girls. Teachers' rooms and store-rooms. Drawing school. Manual training or Slöjd room. Kitchen, dining-room, &c.

Austria.

Small Schools, 375 (9).—Teacher's residence and school in one block. Large entrance hall serving as cloak-room for both sexes. School-room lighted on two sides. Offices connected with the building by a lobby. No covered playground.

Medium-sized Schools, 376 (9).—Two-storeyed building. Offices in the building. Passage used as cloak-room. Two teachers' rooms and store-rooms. Open playgrounds and school gardens.

Large Schools, 377 (9).—Building divided into two halves for boys and girls. Offices approached through a lobby off each floor. Cloaks hung in corridor. A well-equipped gymnasium of one storey placed by the side of the main building. Playgrounds and small garden. School baths not usually found. Manual training room, kitchen and dining-room. Teachers' rooms and store-rooms. Drawing school and library.

Finland.

Small Schools, 375 (10).—Teacher's residence and school in one building. Wide corridor forming common cloak-room. School-room lit from one side. Offices in the building.

Medium-sized Schools, 376 (10).—One-storeyed building with two entrances and cloak-rooms. Manual training-room. Gymnastic and assembly hall. School-keeper's living-rooms. Covered playgrounds. Offices outside building. Small garden.

Large Schools, 377 (10).—Building divided into two halves for boys and girls. Broad central corridor used as cloak-room. Gymnasium often found in main building. Offices in playground. Special conveniences for teachers being placed in the building. Open and covered playgrounds for each sex. Teachers' room. Manual training and Slöjd room.

Sweden.

Small Schools, 375 (11).—Teacher's residence and school forming one group. Large common cloak-room. A large Slöjd room is always found. School-room lighted from two sides. Offices away from the building.

Medium-sized Schools, 376 (11).—One-storeyed building. Boys' and girls' school separated by teacher's house. Large cloak-rooms. Offices outside building. Hall for gymnastic exercise with cloak-rooms. Open playground. Small garden.

Large Schools, 377 (11).—Three floors and basement. The building is divided into three departments; one for the smaller children from seven to nine years, one for boys, and one for girls. Three separate entrances and staircases are provided. Cloak-room provided to every two class-rooms. Gymnasium in separate building. Offices in the playground. Separate playgrounds for boys and girls. Covered playgrounds are often found. Teacher's house often provided near the school. Shower-baths provided in basement. The class-rooms that are adjacent are provided with a pass door, in order to facilitate the visits of the Head Teacher and Inspectors. On the top floor are placed the art school, Slöjd rooms, kitchen and dining-room, room for teachers, &c.

Switzerland.

Small Schools, 375 (12).—Teacher's residence in school building, commonly on first floor over the school. Large common cloak-room, from which the offices are entered. Manual training room usually provided. School-room lighted from one side.

Medium-sized Schools, 376 (12).—Two-storeyed building. Boys on the ground and girls on the first floor. Offices in the building. Passages as cloak-rooms. A small teachers' store-room on each floor. Gymnasium with apparatus-room and small sanitary annexe. Open playground. School garden.

Large Schools, 377 (12).—Building divided into two halves for boys and girls. Corridors used for cloak-rooms. Offices commonly inside the building, approached off each floor. Gymnasium in separate building. School-keeper's rooms in the buildings. School baths, kitchen and dining-room in basement. Teachers' room. Drawing school. Manual training and needlework rooms.

Chapter XXI.

ELEMENTARY SCHOOLS

(Continued).

HIGHER ELEMENTARY SCHOOLS—HIGHER GRADE ELEMENTARY SCHOOLS.

Difference between Higher Grade and Higher Elementary Schools—Origin of Higher Elementary Schools—Differences in the Buildings from the Elementary School—The London Higher Elementary Schools—The Central Higher Grade School, Manchester—Examples at Scarborough, Nottingham, and Falkirk.

A careful distinction must be drawn between Higher Grade Schools and Higher Elementary Schools. These terms have been loosely applied to various kinds and classes of schools, and considerable confusion has thereby been caused. At the present time the name Higher Elementary School is applied to schools which, confining their work to the upper standards of the Elementary Schools, try to keep their pupils on until the age of fifteen or sixteen, and in some ways may be regarded as a form of Third Grade Secondary Schools. For a long time these schools were simply called Higher Grade Schools, but this term, although still used in many cases to denote schools that might more properly be called Technical Schools, is now principally applied to Elementary Schools rather above the ordinary Public Elementary Schools. Fees are commonly charged, and the term has more a social significance than actually implying anything more advanced in the way of curriculum. This confusion in name accounts for the fact that the plans shown illustrate buildings that are called by both names.

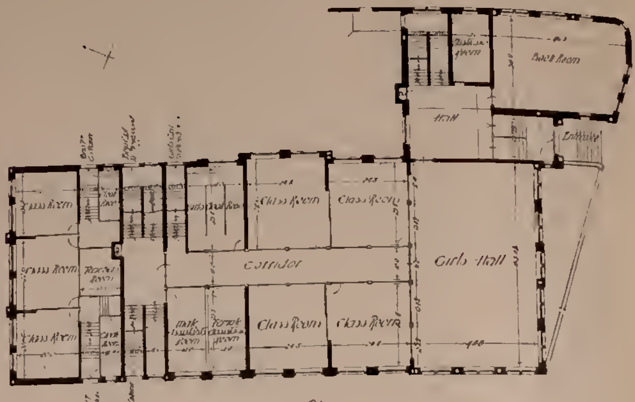
The Higher Elementary Schools are, with regard to their buildings, subject to a special set of rules (see Appendix) issued by the Board of Education, which limit the size of classes to 40 and the area of floor space per head to a minimum of 15 sq. ft.

The Higher Grade Elementary Schools are governed by the rules applicable to the ordinary Public Elementary Schools. The origin of the true Higher Elementary Schools may be shortly stated.

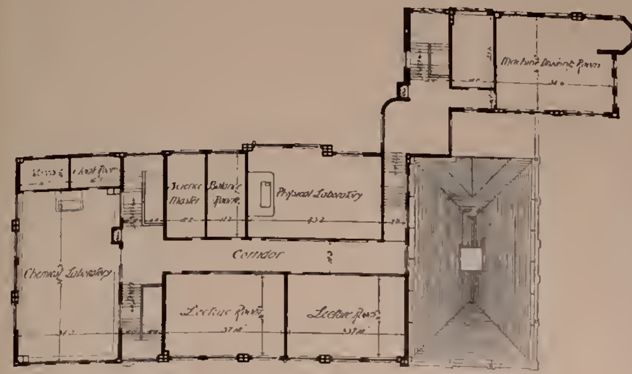
As soon as the attendance at the Elementary Schools became somewhat more regular, it was found that in some schools there were a number of pupils whom it was possible to take beyond the seventh or highest standard as recognised by the "Code" of the Board of Education; although many schools still found that six standards were all they could manage. The raising of the leaving age, and the abolition of half-time, with further restrictions and more stringent regulations against exemption, naturally tended to increase the number of the pupils in the higher standards. As a rule, however, except in the case of very large schools, there were not a sufficient number of these advanced scholars to form a class, and they were generally taught by the master taking Standard VII. at the same time; while teachers in small schools, or in those neighbourhoods where the parents took away their children at the earliest opportunity, probably had to take Standards V., VI., and VII. together. The London School Board in 1887 made an attempt to meet this difficulty by appointing one school in each group, which was to have a special class, and to which any children sufficiently advanced should come from the other schools in the group. In these schools some arrangements were made for the better teaching of science, by the provision of laboratories, &c.

This was open to many objections. The other schools naturally did not like sending on and so losing all their most promising pupils; the selected schools became overcrowded in the lower forms owing to parents sending their children there in preference to other schools, in order to make sure of their admission to these high forms. It was in order to provide for this class that the special schools known first as Higher Grade and later as Higher Elementary Schools were erected. These are now recognised by a Minute of the Board of Education, which provides that they shall be separate schools, with a four years' course beginning with Standard IV. No pupil is admitted to these schools without having attended for at least two years at a Public Elementary School, and having a certificate from a Government Inspector that he or she is capable of profiting by the instruction in the higher school.

The buildings for Higher Elementary Schools differ from the ordinary Elementary Schools chiefly in the smaller size of the classrooms, and in the provision of rooms for special instruction, such as laboratories, rooms for drawing, manual instruction, needlework, domestic economy, &c. The number of scholars attending one Higher Elementary School is limited by the "Code" to 300, for which number

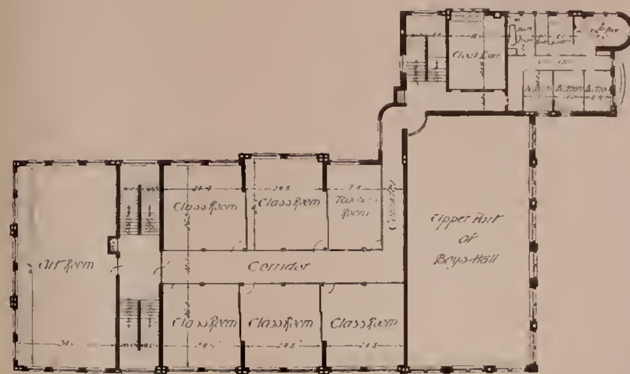


Ground Plan



Third Floor Plan

Basement Plan



Second Floor Plan

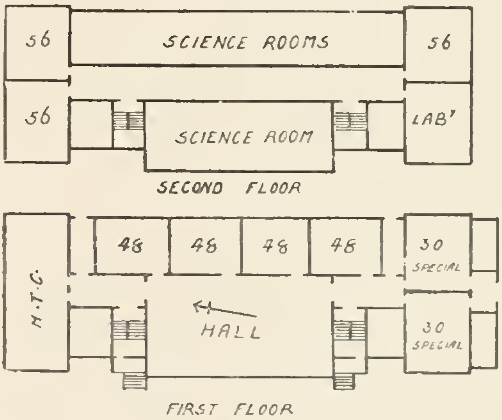
381A 381D. THE CENTRAL HIGHER GRADE SCHOOL, MANCHESTER.

The Manchester School Board.

Potts, Son, & Hennings, Architects

ten class-rooms would be required, and of which four at least should be capable of accommodating 40 scholars.

The regulations further require that not less than 15 sq. ft. of floor space should be provided for each scholar in the class-room, which is to be furnished with single desks, the gangways to be 2 ft. wide, the laboratory accommodation to be as follows :—The laboratory must be sufficiently large to provide at one time for the largest class in the school. A separate laboratory should generally be provided for chemistry and for physics. A laboratory should afford 30 sq. ft. of floor space for each scholar, the minimum size to be 600 sq. ft., but if possible it should be somewhat larger. When the laboratory accommodates more than 25 pupils, a second teacher is required. Laboratories must be fitted with suitable tables, which must be well lighted. They should be properly supplied with gas and water. For chemical laboratories, sinks, cupboards, and the necessary fume closets must be provided. A small balance-room should be added if required.



379, 380. Diagram showing a Higher Elementary School.

In addition to the class-rooms and laboratories it is desirable that a Higher Elementary School should include at least one lecture-room, which should be fitted with a lecturer's demonstration table and properly arranged seats.*

The plans of these schools vary from a building little different from an Elementary School, but having the top floor devoted to science teaching, to buildings so elaborate that they ought more properly to be called Technical Schools. The diagrams in Figs. 379 and 380 show the adaptation of the ordinary type of London Board School to the purposes of a Higher Elementary School. This, it will be noticed, is very similar in general arrangement to that of the Cobbold Road Elementary School (see Figs. 315, 316), the top floor being devoted to science teaching, drawing, needlework, clay modelling, &c.

The Central Higher Grade School, Manchester.—In Fig. 381

* For science rooms, see *ante*, Chapter V.

are shown the plans of a large and important school of this type recently erected in Manchester. There is accommodation in this building for 1,450 pupils. Of this number reserve class-room is provided for 250. There are 700 pupils in the elementary grades, and 500 in the upper standards, or, as it is called, the School of Science. In 1900 there were, of 1,048 scholars on the books, 421 in the advanced section (298 boys and 123 girls), and 627 in the elementary section. All the pupils entering are required to have passed the Fourth Standard of an Elementary School or an equivalent examination, and pay a fee of 6d. a week in the Elementary School, and the same in the advanced classes if the child of a ratepayer, otherwise the charge is 1s. The fees are, however, remitted when it seems necessary or desirable. In the basement of the building, besides the gymnasium, manual training room, and cookery instruction room, there is a dining-room where scholars are allowed to dine, and may have the food they bring with them warmed, and be supplied with tea or coffee at a small charge. This is found very necessary, as many of the pupils come considerable distances, some arriving by train. There is a library 44 by 31 ft. on the ground floor, and a separate assembly hall 80 by 40 ft. for boys and girls. The class-rooms have in most cases movable partitions, and are arranged to accommodate classes of different numbers. The studio is a large room 64 by 34 ft., arranged with desks for model and free-hand drawing. The chemical laboratory on the third floor has benches for 40 pupils, as has also the physical laboratory. There are small additional chemical and physical laboratories for students doing advanced work.

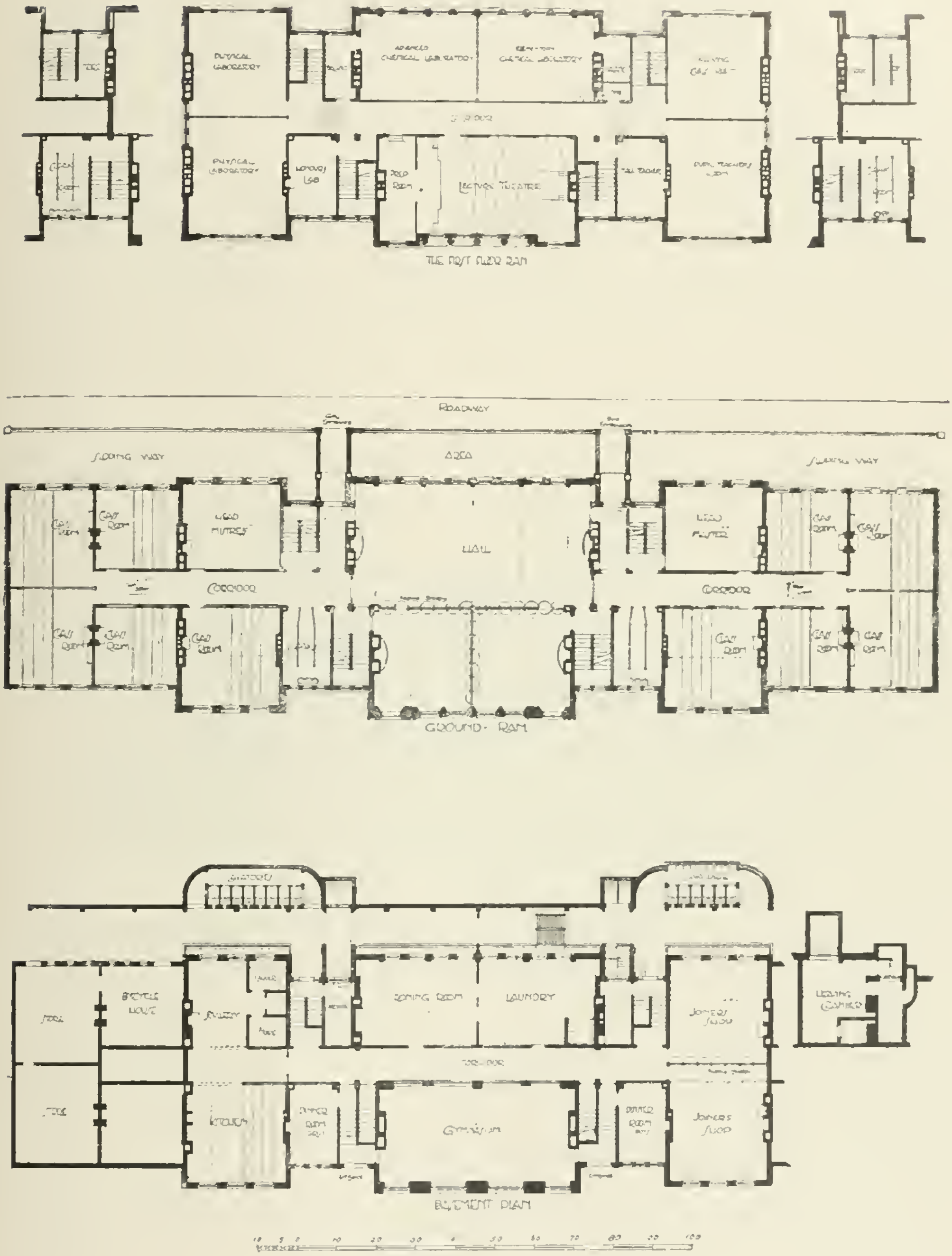
The next example (Figs. 382-384) shows a *Higher Grade School at Scarborough*. This is a considerably more elaborate building, a larger amount of space being devoted to rooms for technical teaching in proportion to the class-room accommodation.

The basement is 14 ft. high in the clear, and one of its features is a gymnasium 20 ft. high, reached from both playgrounds by means of boys' and girls' open porch and a separate staircase. There is also a complete laundry, consisting of ironing and washing rooms, with dryers, for the instruction of 40 girls in two classes. Immediately adjoining this is the cookery kitchen, with scullery and pantries abutting on the girls' main staircase. There is accommodation in the cooking kitchen for 36 girls, and it is fitted with gas stoves and open fireplaces, and all necessary shelving, tables, cooking utensils, and requisites for the instruction classes.

Towards the east side are two dining-rooms for 12 children each,

384A. Higher Grade School, Scarborough.

Hall, Cooper, & Davis, Architects.

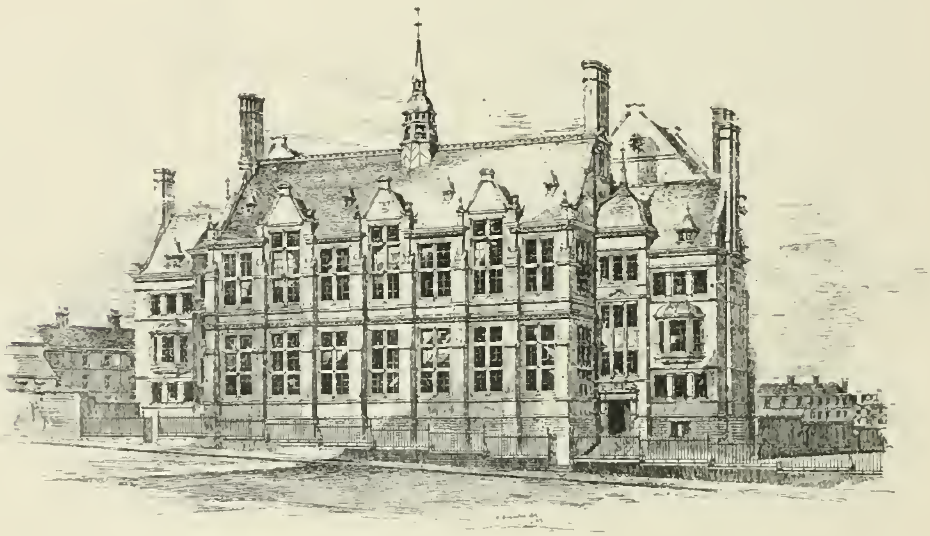


382-384. HIGHER GRADE SCHOOL, SCARBOROUGH.

The Scarborough School Board. *Hall, Cooper, & Davis, Architects.*

accessible from the respective playgrounds. Adjoining the boys' dining-room is a spare class-room, and immediately adjoining this is a joiner's shop, with accommodation for 40 boys. There are also unpacking rooms, store-room, cloak-room, and lavatory for each department using this floor. A caretaker's room, a boiler-house, heating chamber, &c., are also provided for.

The ground floor is 15 ft. 9 in. in the clear, and is fireproof. The boys' and girls' main entrances are connected with the new approach road by bridges spanning the areas. Two cloak-rooms adjoin the main entrance, each having 300 pegs and lavatory basins. There are on this floor four class-rooms with accommodation for 40, there are four with



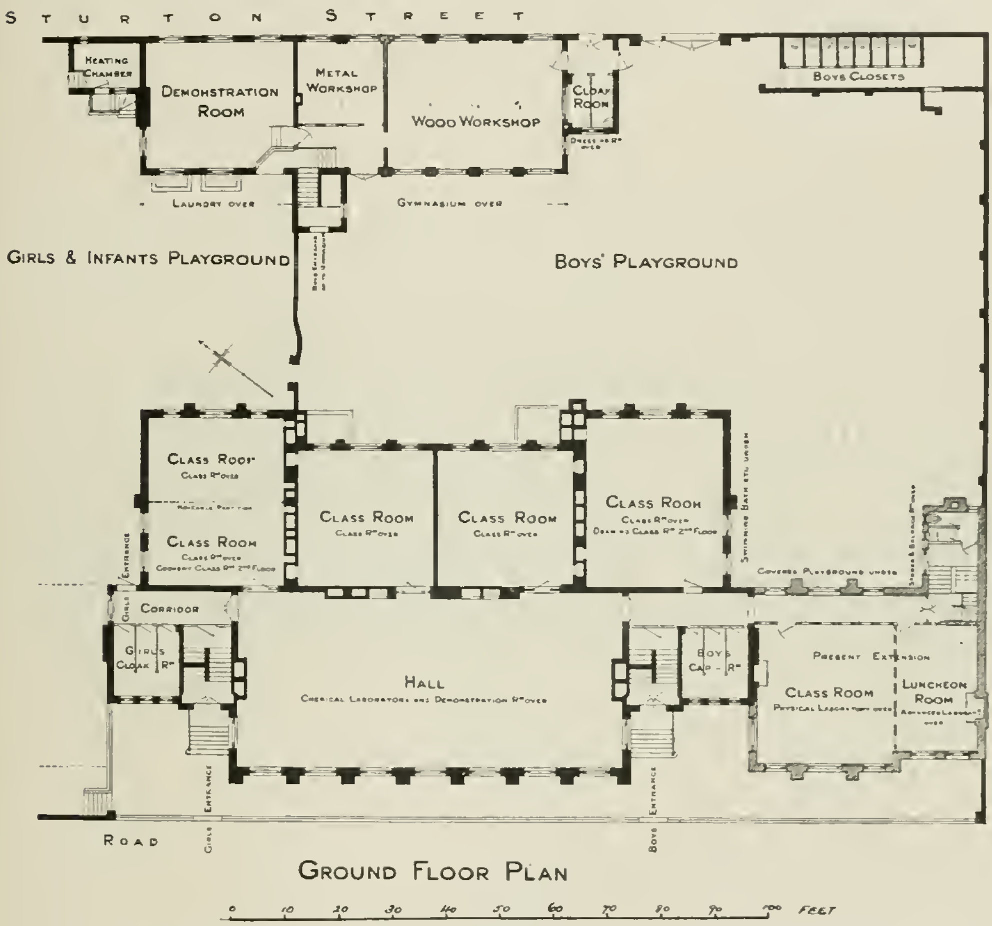
385. THE STANLEY ROAD HIGHER GRADE SCHOOL, NOTTINGHAM.
A. N. Bromley, Architect.

accommodation for 50, and four with accommodation for 60, making a total of twelve class-rooms with accommodation for a total of 600 children. Each class-room is provided with book cupboards, with sliding doors, arranged in recesses in internal walls. Out of the twelve class-rooms provided, ten face the south.

The central hall covers a superficial area of about 3,600 ft. On one side is to be found the Headmaster's room, ante-room, packing store, with lift communicating, and on the other side the school lavatory.

On the upper floor there are two rooms for assistant teachers—one for each sex—placed over the cloak-rooms, and reaching from the second half-pace of the main stairs. There is also a class-room for

pupil teachers' instruction, containing 480 superficial feet. A chemical laboratory is provided, with fifty benches divided by glazed partitions into sections, and a room for honours work, the whole being fitted up to the regulations of the Science and Art Department with fume cupboards, blackboards, and stores for reagents, &c. There is a small



386. The Stanley Road Higher Grade School, Nottingham.

A. N. Bromley, Architect.

balance-room overlooked from the chemical laboratory properly fitted up with glass cases, working table, and draught closet. A physical laboratory for 32 students is provided, and is divided into two sections by a screen. There is a lecture-room to accommodate 100 students, provided with demonstration table and platform, and lantern platform, with shutters to the windows for darkening the room during the lantern

lectures. A preparation-room is connected with the lecture theatre. There is a drawing class-room with top and north studio light to accommodate 60 elementary students, and a small class-room for the same purpose for advanced students. These rooms are placed near the boys' staircase, but are accessible from the other staircases. Besides a spare class-room, with accommodation for 60, a book store, with lift and caretaker's cupboard, are provided.

The latrines are separated from the school and placed under the roadway adjoining the area.

387. The Falkirk High School.

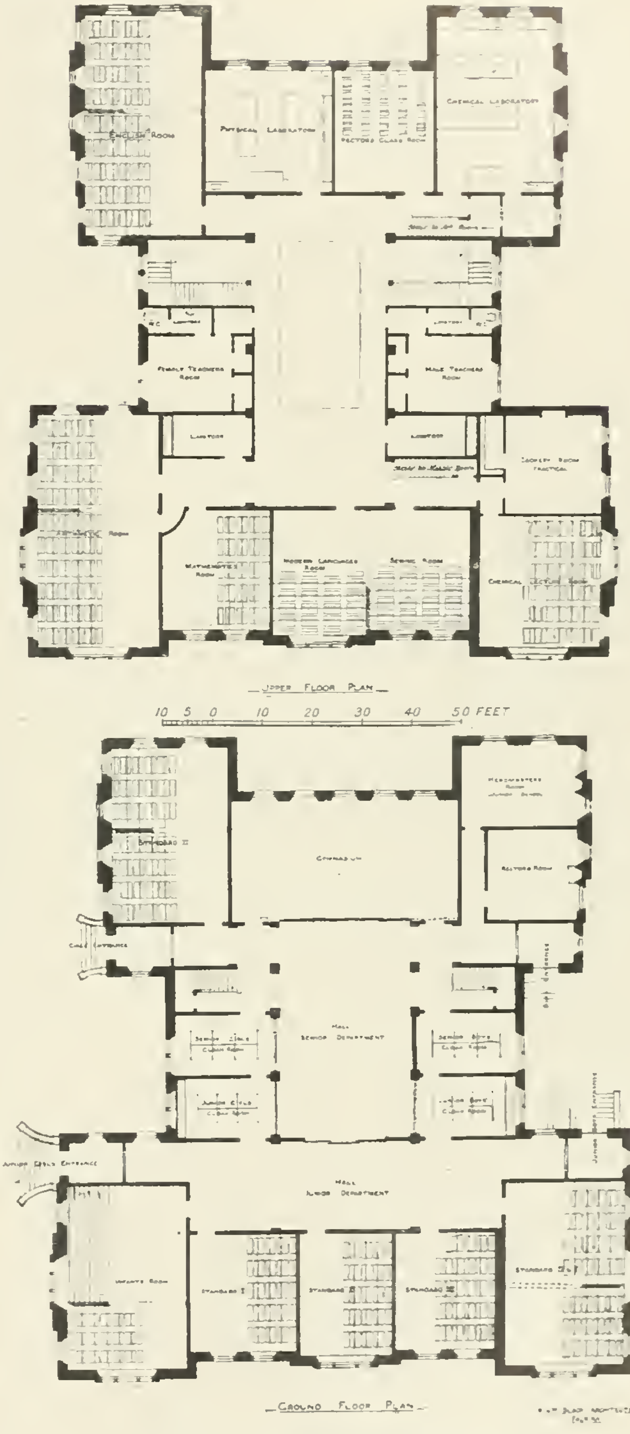
A. & W. Black, Architects.

The whole building is warmed by open fires and steam radiators at low pressure. The school is ventilated by a system of natural ventilation with extra shafts from each room, with inlets at the ceiling and floor levels, and carried into the roof ventilator. There are fresh-air inlets at the window levels direct from the outside, passing through steam radiators, the rooms on the top floors having extractors in the ceilings. The building is lighted by sash windows, all of which are made to open.

Stanley Road Higher Grade School, Nottingham (Figs. 385, 386).—This school is well situated upon an open piece of ground. The class-rooms open off the large assembly hall, which measures 70 by 32 ft., and have sloped floors instead of steps to raise the back rows. On the first

floor in addition to the class-rooms is a chemical laboratory, 40 by 27 ft., providing bench room for 56 pupils, and a lecture theatre. On the third floor is placed the cookery class-room with its scullery, stoves, &c., and the studio. The accommodation for teachers is provided in a mezzanine floor. Separate dining-rooms for boys and girls are provided for those pupils who come from a distance. There is a swimming-bath arranged in the basement; while a separate block of buildings provide a gymnasium, physical laboratory, and laundry. A noticeable feature is a garden in the playground measuring some 88 ft. in length and 10 ft. in width, in order to illustrate lessons in botany, physiography, &c. The ventilation is arranged on the Plenum system. The incoming air is drawn through a cleaning screen, being then warmed and then driven into the rooms by a fan worked by a gas-engine.

The Falkirk High School. — Figs. 387-389



388, 389. The Falkirk High School.

show the arrangements of a Scotch School combining an Elementary and Higher School in one building, the first four standards forming the junior department. The ground floor of the school is occupied by the junior department. The class-rooms, six in number, can be converted into nine by glass sliding partitions. In addition there is cloak-room and lavatory accommodation, besides a private room for the Headmaster. On this floor there is also situated the gymnasium, as well as the rector's business room. The school is planned on the central hall system. By means of sliding partitions, the central hall, junior department hall, and gymnasium can be thrown into one apartment when occasion arises. On the upper floor of the school are situated the class-rooms of the senior department, and chemical and physical laboratories, with large lecture-room. Space has been found for art and music rooms by raising the building to three storeys in height at both back and front. The class-rooms are heated by low-pressure hot-water pipes. The accommodation of the school is:—Junior department, 426; senior department, 515—total, 941. It will be noticed that in some cases the class-rooms are lighted by windows placed at the back of the room.

Evening Continuation Schools.—The schools hardly concern us here, as all questions arising in connection with them are educational, the buildings being the ordinary Elementary Schools. As mentioned above, some provision in the way of desks might be made to meet the needs of the pupils attending these schools, of whom a considerable number are adults.

Chapter XXII.

ELEMENTARY SCHOOLS

(Continued).

SCHOOLS FOR "SPECIAL" CHILDREN.

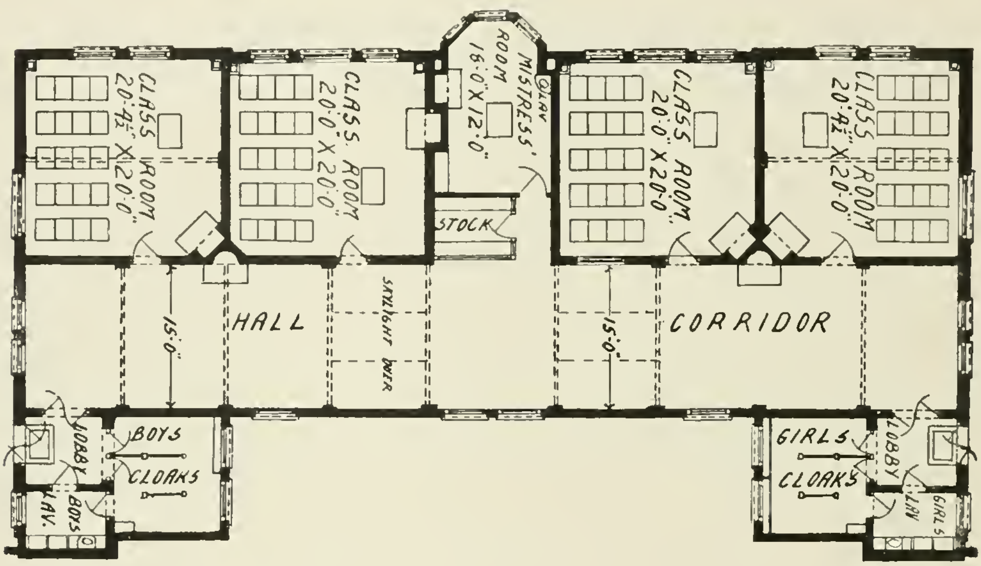
Buildings for Special Classes of Children Blind and Deaf—Mentally Defective—Cripple Schools—Poor Law Schools—Cottage Home System—Barrack Schools—The Chase Farm Schools, Enfield—The Hornchurch Cottage Homes.

Schools for the Mentally Defective, Deaf, and Blind.

There are a certain number of children who, not being sufficiently imbecile to be sent to a lunatic asylum, are yet too deficient in mental power to profit by the instruction given in the ordinary Elementary Schools. For these children special classes are formed in the ordinary schools, or, where there are a sufficient number, special schools, arranged expressly with a view to provide for their more efficient teaching. A certain number have so far profited by their work in these schools that they have been able to return to the ordinary Elementary Schools. Power is given to School Boards to deal with this class of children under the Defective and Epileptic Children's Act of August 1899. This Act directs school authorities to take steps to ascertain what children in their schools are so far mentally wanting, not being idiots or imbeciles, as to be incapable of being taught by the ordinary Elementary School system, and to make such provision for their instruction as may be suitable. The Act gives them power to force any parents they deem necessary to allow such children to be medically examined, and at the same time makes it obligatory on the school authorities to have examined any child whose parents so wish it, in order that the child may be sent to a "special" school.

School authorities have three methods of dealing with such children—either by instituting special classes for them in ordinary Elementary Schools; by boarding out the children in some house near to

an existing "special" class or school; or by establishing themselves "Special Defective Schools." In the second method they may contribute towards the expenses of the children placed in or near a "special school" belonging to another Board. They are further empowered to provide guides or conveyances for children who would otherwise be physically unable to attend school. These arrangements are to be made also for epileptic children. The parents of such children are liable for contributions towards expenses of guides, conveyances, meals, &c., but of course not towards the education. In the case of defective, epileptic, blind, or deaf children, the age of compulsory attendance at school is lengthened to sixteen years.



390. A "SPECIAL" SCHOOL.

The London School Board. *T. J. Bailey, Architect.*

Buildings for Defective Children.—The regulations as to the buildings for this class of children are given in the Appendix. Very much larger floor space is required for these children than in the case of the ordinary Elementary Schools, 20 sq. ft. being required for each child in average attendance. In the class-rooms for teaching deaf children it is of the utmost importance that the lighting should be very strong. A top light is often a great assistance in enabling both the children and the teacher to watch the movements of the throat and lips, upon which so much of the teaching depends. Fig. 390 shows one of these schools as constructed by the London School Board. The class-rooms are all on the ground floor, and have open fireplaces. The hall

takes the form of a wide, well-lighted corridor, for the purpose of drill and assembling. It is usual in schools for mentally defective children to supply arrangements for washing children, much on the lines of the arrangements described in the account of the German Schools—that is to say, spray baths, two to each department being usually found sufficient. The school illustrated will take 80 children.

Schools for Crippled Children.—During the last few years the London School Board has been making considerable efforts to provide for children who, though not mentally deficient, are crippled to such a degree as to prevent their attendance at the ordinary schools. For this purpose there is provided an ambulance, which goes round with a nurse in attendance and takes the children to and from school. In one or two cases schools for the mentally defective have been altered for the purposes of cripple children. These buildings answer the purpose well, except there is no provision for cooking arrangements. Since the children in the Cripple School cannot return home in the middle of the day for their dinner, it becomes necessary to provide meals.* In the buildings that have been converted, the room for the spray baths not being required has been turned into a kitchen, but this is of hardly an adequate size in which to cook for some 30 or 40 children. The hall or corridor serves well enough for the dining-room by the use of movable trestle tables. A plan as shown above, with the addition of a kitchen and scullery, would serve excellently for a Cripple School, though it would be an unfortunate neighbourhood that could provide sufficient crippled children to fill a school of 80. Two class-rooms would usually meet the wants of most districts, and by means of separate entrances, dividing the building, &c., it could well be confined with a mentally defective centre.

Provision should be made so that the ambulance can drive right up to the door of the school, to enable the children who are incapable of walking to be easily carried in.

The main difference between a school for cripples and other schools lies in the desks and chairs. A fair proportion of the children will be found able to use the ordinary form of desk, so that a considerable number of these will have to be provided. For the others, a few couches for those who are unable to sit up, and arm-chairs supplied with foot-rests. The chairs as used at present are not entirely satisfactory.

* These meals are managed by the nurse in charge. The parents are expected to pay for their children's dinner, and the nurse collects the money on her morning round to pick up the children.

The desks which are arranged to fit on the arms are too low and too near for comfortable work, while the foot-rests, being made so that they can be folded back under the chair, are too short for any but the smaller children. The system of small, light, movable tables that can be placed across the chair appear much more satisfactory. These schools, which are in their experimental stage as yet, do appear to supply a means of teaching a certain number of children who are not in any way deficient mentally, but who by their physical disabilities are prevented from attending school.

The regulations for Boarding Schools for children who are deaf and blind are given in the Appendix. It is considered advisable that the numbers should be carefully limited, and that, while something on the Cottage Home principle would probably offer the best solution of their arrangement, no cottage should take more than ten children, and those all of one sex.

POOR LAW SCHOOLS.

Poor Law or District Schools are establishments for the reception of the children of paupers, or in some cases those of widows left with more children than they can be reasonably expected to provide for. In the case of children with able-bodied parents living, the parents must be in the Workhouse. These schools are built and managed by the Poor Law Guardians, who are responsible to the Local Government Board, by which body a new building has to be approved. There are of course a considerable number of ways in which Guardians can deal with the children of the occupants of the Workhouse. The desirability of separating them from the adult paupers is now well recognised, and the old Workhouse School in which the children were taught while living with their parents in the Workhouse has now practically ceased to exist. At the present time the children are either boarded out in ordinary working-class families, or placed in Isolated or Scattered Homes under the care of a man and wife appointed by the Guardians, and attend the ordinary Elementary Schools; or else they are collected into large schools,* either on the "Barrack School" or "Cottage Home" system, but which are complete in themselves. Each of these systems has strong supporters, and meets with equally strong opposition. The objectors to the large schools say that the aggregation of a large number of inmates in one building is bad hygienically; that the life is dull and tedious; that they destroy all individuality and stunt the

* Two or more Unions may arrange to join together in supporting a common school.

faculties ; and so turning out children who when they leave are helpless, incapable of making their own way in the world, and marked with the pauper taint. But, while this may be true of the older type of school, no one who visits one of the large Poor Law Schools at the present day and sees the care and interest taken in the children, can fail to be favourably struck. The children look bright and alert ; they have numerous interests—cricket matches with neighbouring schools, expeditions, the school band, carpenter's shops, &c.—while the superintendent has usually any number of proofs of the after-success of the children. The "Cottage Home" system was introduced as an attempt to remedy what was supposed to be a defect in the best managed "Barrack" School, *i.e.*, the loss of home life. The idea of this system is that a small number, generally from 15 to 20 children, should be placed in separate cottages under the charge of a man and his wife, who are known as the "foster-parents," and who are supposed to give them the feeling of home which is thought to be so important. The resemblance to home is probably more imaginary than real, since usually the sexes are divided, and there are often 30 children in a cottage. The number is of course often much smaller, being sometimes as low as 10, but even then, as the school makes a complete colony within its boundary, the institutional feeling is only to a small extent got rid of. The separation of the boarding-houses is naturally a great advantage from the point of view of health. A careful consideration of the relative advantages of the different systems will be found in "Children under the Poor Law," by Sir William Chance, Baronet, in which some figures given as to the cost of maintenance of Barrack Schools and Cottage Homes seem to show that there is not a great deal to choose between the two systems on the score of expense.* The Local Government Board have, however, now definitely decided in favour of the Cottage Home system, and strongly discourage the building of Barrack Schools.

The Buildings and Grounds.—The Local Government Board have formulated some general principles upon which such buildings should be based, but, perhaps wisely, as there is so much difference of opinion, have not laid down any regular code of regulations, but an early application to them for an opinion will probably save much trouble in obtaining the necessary certificate afterwards.

The Site.—As these schools are generally placed out in the

* Children under the Poor Law, p. 142.

country, and are not necessarily within the area of the Unions they serve, it is possible to choose some place where ample space can be secured, with free surroundings. The actual area would vary according to the kind of school. For a "Cottage Home" School Mr Gordon Smith * suggests an allowance of about 7 acres for each 100 children—giving one-third of an acre to each cottage for 15 children—while a school of 300 would require about 6 acres for football and cricket grounds. In the case of a "Barrack" School, as the buildings would be close together, less would be required, but it should probably not fall much below 12 to 15 acres. This is exclusive of farm land. The arrangements for recreation and exercise should be ample and attractive, as the children of this class, not taking naturally to games, require much encouragement. It not infrequently happens that the best part of the ground is devoted, in preference to this, to the growing of potatoes and other produce, to the detriment of the physical recreation of the pupils.†

In the dormitories the width usually allowed is 18 ft. In this case the Local Government regulations require 3 ft. 9 in. of wall space and 36 sq. ft. of floor space. If the width is reduced to 15 ft., 4 ft. of wall space must be provided. These measurements cannot be considered sufficient for healthy conditions in a sleeping-room.‡

The danger of infection is one of the difficulties to be provided against in these schools where large numbers of children are collected together. Great care is taken, by means of probationary wards, to make sure that children entering the school do not bring in any infectious diseases with them. In regard to the arrangements for ablutions, precautions are taken to ensure against the possibility of the same water serving for two children, by the use of sprays of running water in place of basins. A description of various methods that can be employed for the rapid washing of large numbers is described on page 462. The sanitary arrangements are usually placed in a detached building, which should always have a covered or well-sheltered approach. The closet accommodation laid down by the Local Government Board is for girls 15 closets per 100, for boys 10 closets per 100 and urinals in proportion. There is subjoined an example of a "Barrack" School and a "Cottage Home" School.

The Chase Farm Schools, Enfield.—These schools belong to the

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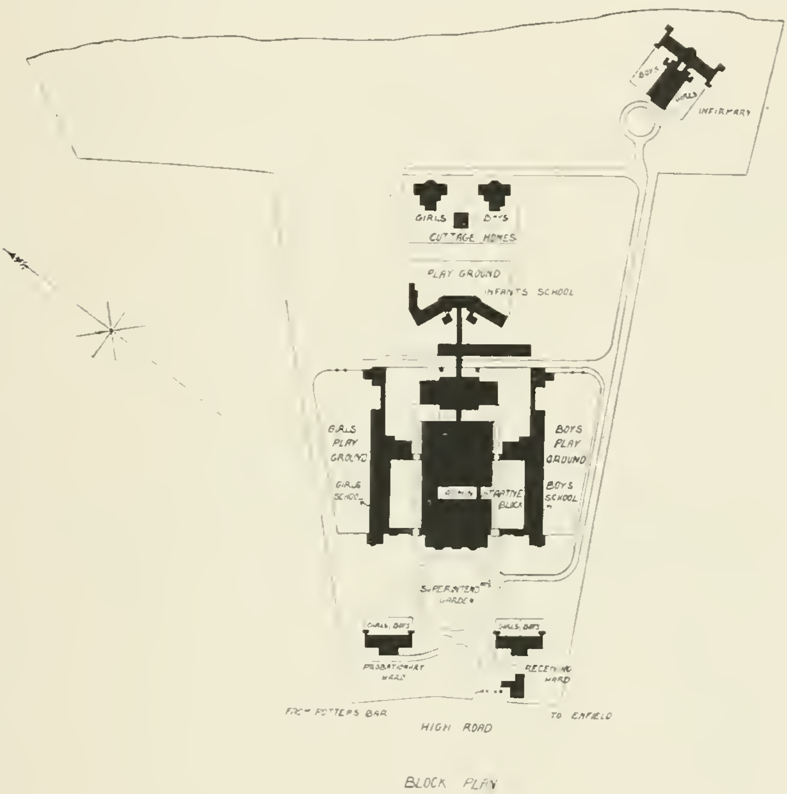
* Suggestions as to the Planning of Poor Law Buildings, p. 15, P. Gordon Smith.

† See Treatise on Hygiene and Public Health, p. 703, Stevenson and Murphy.

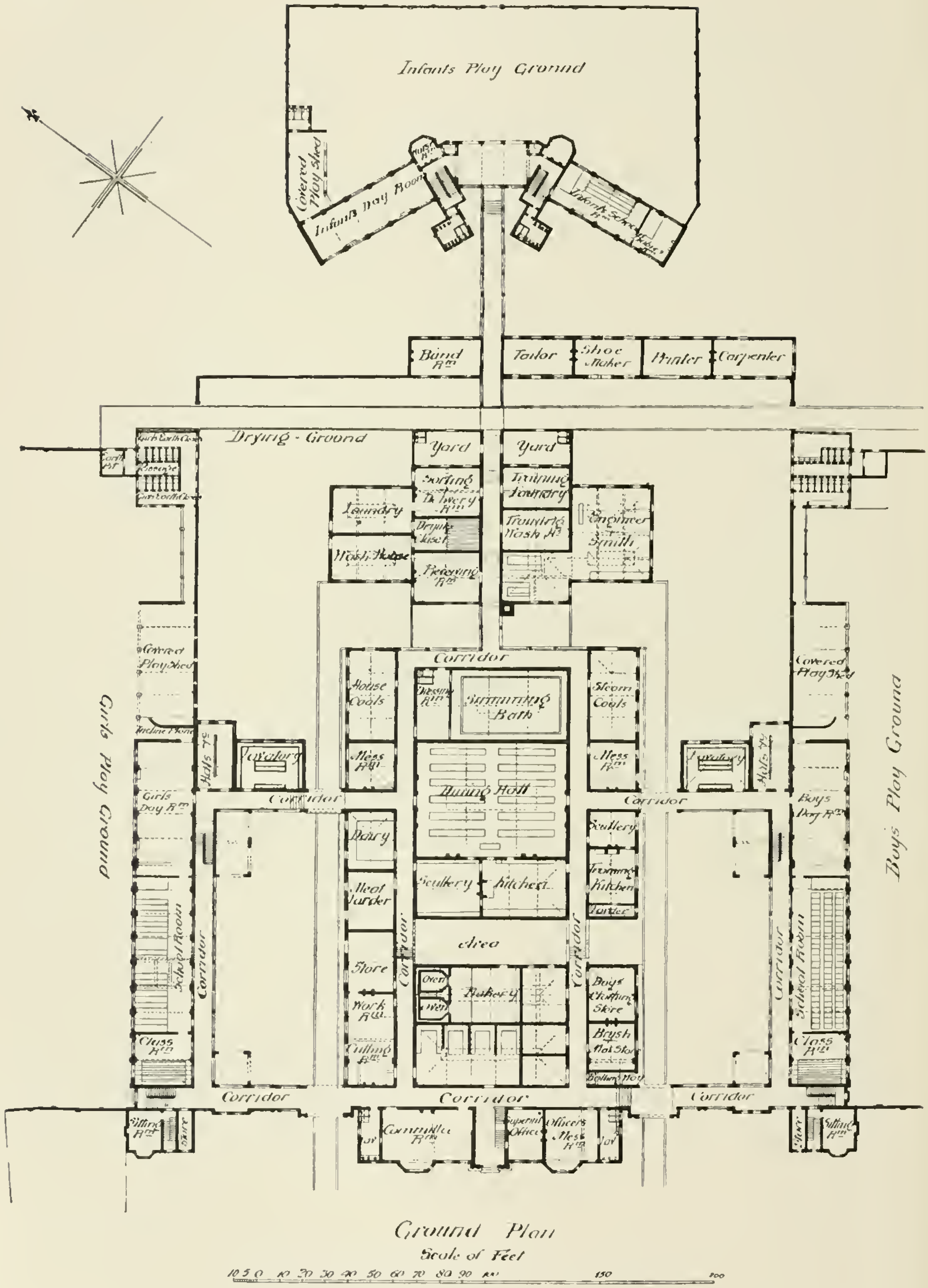
‡ See above, pages 240, 241.

Edmonton Union. The general scheme will be easily understood from the block plan (Fig. 391). Immediately to the right of the entrance gate stands the porter's lodge. Behind this is the receiving ward, with the probationary wards on the opposite side in which the new arrivals undergo a fortnight's or three weeks' quarantine before being admitted into the school. It often happens that children never get beyond this stage, if their parents may only remain in the Workhouse for a short time, as they are bound to take their children with them when they discharge



391. Edmonton Poor Law Union—Chase Farm Schools.

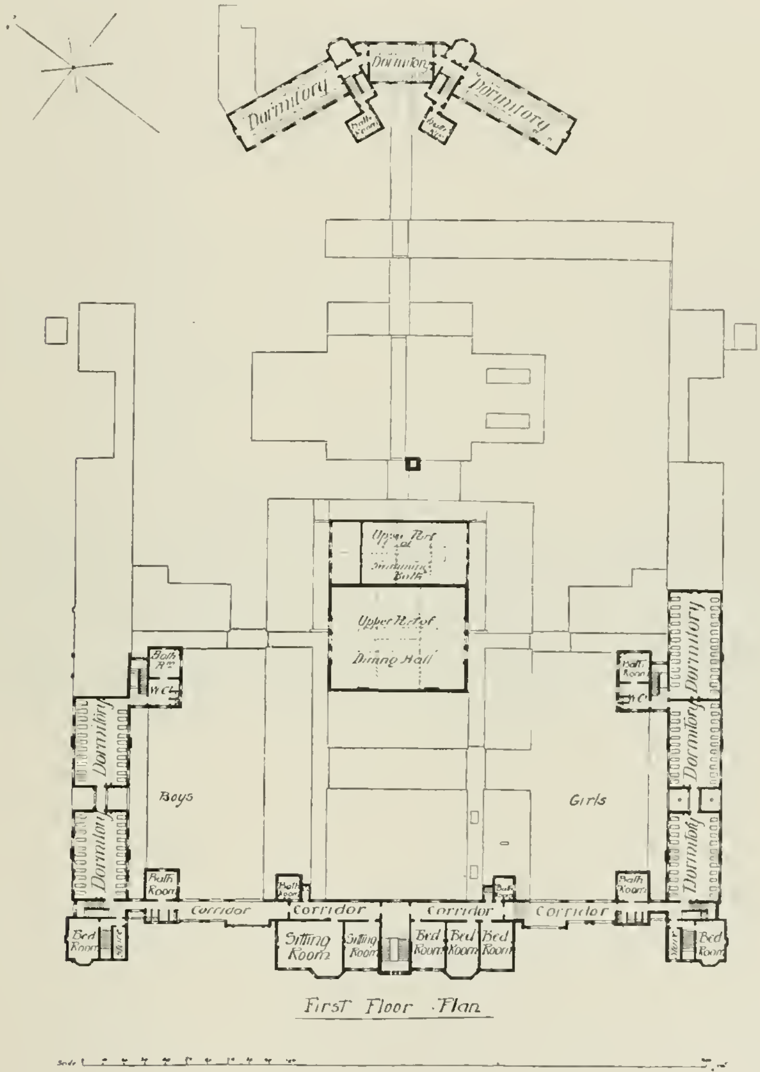
themselves. The main block of the building is shown in more detail in Figs. 392, 393. The general scheme groups all the administrative rooms and buildings that are common to both the girls and boys in the middle, while the dormitories, day-rooms, and class-rooms are arranged in two long narrow buildings on each side, connected by corridors with the main block at two points—the girls on one side, the boys on the other. The Infant School is placed in a detached building behind with its separate playground, &c., but also connected by a corridor to the rest



392. The Chase Farm Schools, Enfield.

Edmonton Poor Law Union. *T. E. Knightley, Architect.*

of the buildings. In the front of the administrative block are placed the superintendent's room, committee room, behind these coming the offices, store-rooms, kitchens, &c. These have to be numerous, owing to the fact that everything required by the school and the children



393. THE CHASE FARM SCHOOLS.

is made on the premises. These tailoring, bootmaking, carpenter's shops, &c., enable the trades to be taught to the boys in addition to supplying what is required for the school. The living-rooms for the children consist of the necessary class-room accommodation, and a large

day-room opening through a covered playshed on to the playground. The arrangements correspond on each side for the boys and girls.

The dormitories are arranged to take twenty-two beds, in rooms separated from each other by open arched corridors, so that any one can be easily isolated if necessary. The corridor which connects them with main building is also open, so that the air can circulate freely all round the buildings. The dormitories are made 25 ft. wide, and are 40 ft. long, thus giving an allowance of 45 sq. ft. per head, an amount which is above that demanded by the Local Government Board. Bath-rooms and W.C.'s are arranged in small spur buildings conveniently to each dormitory.

At a little distance from the main building (see Fig. 391) are

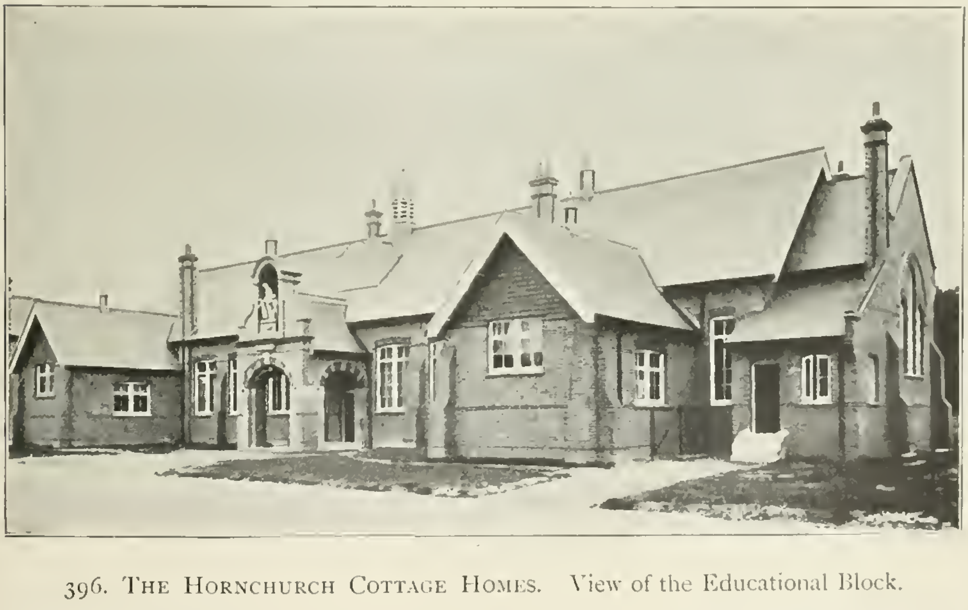
394. THE CHASE FARM SCHOOLS, ENFIELD.

T. E. Knightley, Architect.

situated the infirmary and two Cottage Homes. The latter are used for the purpose of training girls for domestic service, in order to give them some idea of what a small house is like, for many of the children have spent their whole life in the school, and have perhaps never been inside an ordinary house. The whole scheme is compactly and carefully planned, and the superintendent spoke warmly of the suitability of its general plan and arrangement. A general view of the front of the building taken from a photograph is shown in Fig. 394.

The Cottage Home System.—In designing the cottages for a school on this system it should be remembered that the intention of this sort of school is to make the conditions approximate as closely as possible to those of the homes of the working classes, so that nothing

395. THE HORNCHURCH COTTAGE HOMES. View down the Centre of the Cottages.



396. THE HORNCHURCH COTTAGE HOMES. View of the Educational Block.

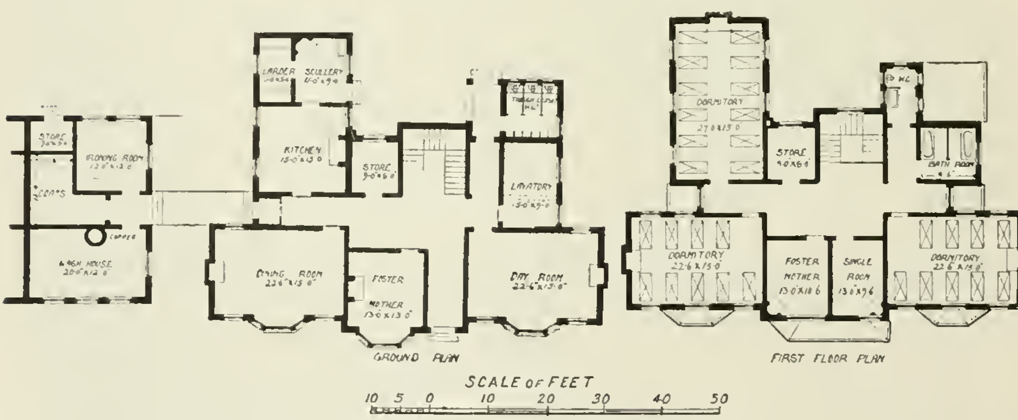
The Shoreditch Union. *Francis Smith, Architect.*

more should be supplied than may fairly be expected in the ordinary artisan's dwelling. As regards the size of the bedrooms, the following dimensions will probably suffice. In the case of cottages which are not intended to take more than 15 children, bedrooms to take about

397. The Hornchurch Cottage Homes. Block Plan of Site.

Francis Smith, Architect.

6 children should afford from 30 to 36 sq. ft. of floor area, the height being not less than 9 ft. In the case of rooms to take 10 or 12, the height must be increased to 10 ft., and the floor area should be at least 36 sq. ft.* In the small cottages for, say, less than 15, it is not neces-



398, 399. The Hornchurch Cottage Homes. Detail of one Cottage.

Francis Smith, Architect.

sary to provide a separate room for the foster-mother, as the children are not in during the greater part of the day and go to bed early. One

* Suggestions as to the Planning of Poor Law Buildings, pp. 16, 17, P. Gordon Smith.

living-room will also serve for meals as well as a sitting-room. Mr Gordon Smith suggests that it is an unnecessary expense to supply elaborately fitted bath-rooms and lavatories, since with the small numbers quite effective ablutions can be made with the ordinary wash-bowls that would be found in a workman's cottage. Arrangements for baths for the children can usually be made by the provision of ordinary hip-baths or washing-tubs.

The Hornchurch Schools belonging to the Shoreditch Union will give a good idea of the general scheme of this class of school. The buildings are arranged on two sides of a road and form a small street (see Figs. 395, 397). Close to the entrance is placed the probationary ward with fourteen beds, and near this the official's residence. There are eleven cottages, each of which takes 30 children. Of these, six are for boys over seven, the remaining five for girls and boys under seven. The school buildings comprise the necessary class-rooms (see Fig. 396), &c., for education on one side of the road, and on the opposite are workshops for bootmaking, tailoring, carpentering, &c., in which the boys are taught the different trades. There is also a swimming-bath, and, a short distance off, a well-fitted infirmary. There are in addition to this, not shown on the plan, two infirmary cottages placed well out of the way, one of which is used for ringworm and skin diseases, the other for ophthalmic cases. Any case of serious infectious disease that occurred would not be treated at the school, but sent to one of the Fever Hospitals. A plan of one of the cottages is shown in Figs. 398, 399. The single bedroom in the girls' cottages is used for the girl who is going out to service next, so that she may learn the looking after and tidying up of the ordinary servant's bedroom. An expenditure of £50,000 was authorised by the Local Government Board for the erection of these schools, which are certified for 337 children.

For further examples of Church Schools and Village Schools, see—

Note.—Large-sized figures refer to volumes, smaller to pages.

The Builder.—38, 515, 570, 600; 40, 602; 41, 25, 140; 42, 734; 44, 74; 45, 146, 433, 752; 50, 302; 56, 146; 57, 192, 388; 62, 140; 67, 82, 434; 72, 442; 75, 558; 79, 366.

The Building News.—38, 540; 39, 384; 43, 354; 48, 88, 970; 51, 800; 52, 554; 53, 244, 860; 54, 617; 56, 719; 57, 252, 286, 318, 386, 482, 679; 58, 64; 59, 178, 818; 63, 629; 64, 503; 66, 377; 67, 517, 605; 69, 481, 739; 70, 130, 600; 72, 631; 74, 266; 75, 679; 76, 8, 777, 841; 77, 193; 79, 807, 913; 80, 175, 693, 797.

The British Architect.—16, 392; 52, 58; 54, 93, 165.

Wesleyan Schools.

The Builder.—39, 322 ; 51, 874 ; 56, 432 ; 59, 499.

The Building News.—46, 672 ; 62, 77 ; 69, 151 ; 73, 113, 825 ; 81, 655.

Infants' Schools.

The Building News.—40, 232 ; 58, 830 ; 67, 319 ; 70, 327, 489, 858 ; 75, 409 ; 78, 190 ; 81, 417.

Industrial Schools.

The Builder.—58, 435 ; 71, 57 ; 74, 321.

The Building News.—38, 100.

The British Architect.—43, 39.

Chapter XXIII.

TEMPORARY SCHOOL BUILDINGS.

Temporary School Buildings—General Arrangements—Alteration and Adaptation of Old Buildings.

The need for the provision of some form of temporary school building is one that often arises, either to accommodate the children of an existing school during rebuilding, to meet the needs of a rapidly growing district pending the erection of a permanent school, or to supply accommodation to meet a temporary demand, such as arises when a large number of workmen are collected into one place for some large engineering work, who will be dispersed upon its completion.

A very fairly satisfactory building can be constructed of corrugated iron, lined with wood, which will last a considerable time, and be capable of re-erection in different places as may be required. Authorities who have to deal with a large area and many schools would probably find the possession of one or two such buildings not only a great convenience but a considerable economy. The usual makeshift plan of housing the children in any building that can be secured, such as a Sunday School, Wesleyan Chapels, and so on, though at times unavoidable, is not very satisfactory. The use of buildings of iron and wood construction is becoming somewhat extensive on the Continent, and at the Conference upon school hygiene, at Nuremburg early in 1904, a paper was read by Von H. Th. Matthias Meyer upon transportable pavilions (buildings of iron and wood of one storey), as the schoolrooms of the future. There was, however, little in the paper in support of the principle of the construction of schools that can be easily movable, and the greater part of his argument being devoted to proving the advantages of having a school upon the ground floor only—a method of building which in this country has been for some time recognised as the most satisfactory method for even large schools, and has been extensively used whenever sites of sufficient size could be obtained, and it does not appear that there is any necessary connection between one-storeyed buildings as

a type of plan and their construction of some such material as iron and wood that will allow of their removal.

His further point that such buildings are very much cheaper to erect is undeniable, but, unless it could be shown that such buildings were at least as satisfactory as those of more solid construction as regards warming, ventilation, &c., the question of cost should not be allowed to determine the question. One argument that can be advanced in favour of temporary school buildings is, that their necessary reconstruction at certain periods would allow of the school building being rearranged to suit subsequent changes in organisation, or size of classes, &c.

Buildings of this sort of construction are difficult to keep at a satisfactory temperature, and are greatly affected by heat in summer and cold in winter. Even if temporary buildings of iron and wood can be so constructed as to be completely satisfactory as far as hygienic requirements are concerned, there are strong objections on other grounds. Perhaps æsthetic considerations should not weigh very heavily in a building whose end is chiefly utilitarian, but the loss of dignity, unattractive appearance, and the feeling necessarily attached to a building of a temporary and somewhat flimsy construction, must surely detract considerably from the power of the school to express the dignity of education, or to exercise the elevating tendency upon which so much stress is laid by educational writers of the present day. A school is something more than a workshop, and deserves to be properly housed, and there is no doubt that a handsome school building may help to bring home to some extent the importance of education.

Generally speaking, the temporary school can follow in its general design the same lines as that of a permanent building. A series of class-rooms, opening off a central hall or corridor, can be well arranged in an iron and wooden building. The lighting and arrangements of desks, &c., must conform to the well-understood principles of school planning. The heating must be properly provided for, and an installation of hot water is probably the most economical method. This of course involves the excavation and building of a heating chamber below the level of the class-room floors. If stoves are used they should be provided with proper brick chimneys, and not merely fitted with an iron pipe through the roof.

Particular care is required to guard the buildings from excessive heat and cold; the rooms should always be provided with a ceiling, and not left open to the apex as is commonly done.

ALTERATIONS TO OLD SCHOOLS.

It is obviously a useless task to attempt any general directions as to the improvements and alterations that are required in order to bring an old school to within a measurable distance of modern requirements, since the work to be done naturally depends upon the shortcomings of the particular building. A few suggestions upon some of the points more commonly met with may, however, be of use. While it may, as a matter of expediency, be desirable to tolerate for a time a building that by its arrangement necessitates some trouble and inconvenience to teachers and children, any point that can be shown to be detrimental in any way to the health of the inmates should be attended to at once, or, if the circumstances are such that effective treatment is impossible, the school should be closed.

There are, unfortunately, a large number of school buildings in the country erected at a time when little or no attention was paid to school planning. The Lancasterian tradition of a large room to take the whole school died hard, for such a building was cheap in construction, required few teachers, and was very useful for parochial purposes and excellent for Sunday School teaching. Consequently there are at the present day numbers of schools consisting of one large room, ill lighted, unventilated, hot in summer, draughty and cold in winter, overcrowded with some two or three hundred children, the teachers shouting in rivalry for a hearing in a babel of noise bewildering to an unaccustomed visitor. However good the discipline, the unavoidable amount of speaking, the small movements, shuffling, &c., of such large numbers, make teaching a matter of great difficulty and discomfort.

In the majority of cases a few class-rooms have been added from time to time, either as an attempt to improve matters or merely to increase the accommodation of the school. Those in the older schools are usually as full of defects as the main building.

As the date at which most of these insanitary old schools were built was prior to the formation of School Boards, they are generally in the hands of the Church, who, though in many cases fully conscious of their shortcomings, have been unable to procure the funds necessary to carry out improvements, which in many cases would mean rebuilding, and in all a heavy outlay.

The Act of 1902, by handing over the burden of maintenance of all Elementary Schools to the Local Authorities, the cost to be defrayed out of the rates, has naturally caused a wide demand for improve-

ments,* and provided a reasonable opportunity for the careful consideration of all school premises in the light of modern hygienic science.

The first difficulty met with in such schools, particularly those situated in towns, is the cramped nature of the site. In the early days of school building a draughty yard in which to place the offices was all that was provided in the way of playground. In such cases the acquisition of additional land is seldom practicable. As a rule, in these old schools every inch of space is taken up with desks, and they are seldom provided with any hall or space where the simplest drill can be given, so that, in view of the importance of physical exercise, the absence of playground very seriously affects the question as to whether the school ought to be allowed to continue at all. While it might seem hard to say that a building otherwise satisfactory ought to be condemned on the lack of playground alone, such a contingency is very unlikely to happen, since the very fact of there being no playground will probably mean that the lighting is bad and incapable of improvement, owing to the close proximity of the adjoining buildings, and that the offices are, owing to lack of space, dangerously near to the teaching-rooms. The want of some space where the children can be turned out for a few minutes is a serious inconvenience, as the building cannot be aired properly between the lessons. There is of course a very great difference between a small playground and none at all. A well-arranged school, with a fair-sized hall for drill and a small playground for each sex of a sufficient size for two or three classes, perhaps supplemented by a flat roof, may well be considered as meeting absolute necessity, and may be all that can be expected in a central position in a town where land is of great value.

On the whole the entire absence of playground will militate so seriously against the efficiency of a school, that, unless some open space can be provided, the school should be removed to more suitable premises. In considering the best method of dealing with the school as a whole, the possibility of giving the existing buildings up entirely to one or two departments, and by the consequent decrease of numbers to provide more opportunity of making satisfactory improvements, should not be lost sight of. For example, a new school may be built for the Infants' Department, and their rooms added to the mixed school, or a new school built for the boys, giving up the whole of the existing buildings to the girls, or *vice versa*.

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* Under the Act the Local Authority are entitled, in the case of a school not provided by themselves, to ask for any reasonable improvements that they may consider necessary. The cost of such improvements to be borne by the managers of the school.

There is a tendency on the part of managers of Voluntary or "Non-provided" Schools, when pressed by the Local Authority for improvements, or a desire for additional accommodation, to hand over the business of providing an Infant School to the Local Authority, keeping in their hands the school for the older children. The advantages of this arrangement, which enables the managers without increasing their buildings to accommodate a larger number of children of an age at which definite religious instruction can be given, are obvious from the point of view of denominational teaching, but, considered simply from the point of view of economy in sites and buildings, and the efficient organisation of the Elementary School work as a whole, it would appear undesirable that the Infant School and that for older scholars should be so separated and under different management.

It will usually be found that an old school building has a very deficient supply of windows : while it may not be possible to ensure good lighting as regards direction, it will, unless the building is shut in by other houses, always be possible to provide an adequate amount. It should be remembered that the evils of lighting from the wrong direction are less felt when the room is very light.

The evils of working in insufficient light are so serious and long lasting that no question of expense should be allowed to stand in the way of an adequate provision of windows. Should this be impossible, the building should be unhesitatingly condemned.

Ventilation.—The arrangements for ventilation are probably non-existent or limited to one or two square holes in the ceiling opening into a false roof, whose only contribution is a strong down-draught of cold air. While any elaborate system of ventilation is out of the question, a great deal can be done by raising the heads of a certain number of the windows to the level of the ceiling, making the top and bottom panes to open as hoppers. If the building is of one storey, properly arranged extract ventilators can be inserted. accompanied by a liberal supply of inlet pipes.

Supposing that it has been possible to so deal with the questions of playground, heating, lighting, and ventilation, that the building can be brought up to a reasonable standard as regards health, there still remains what is from the point of view of the plan the most difficult problem of all, and that is, how to fit the building as a whole to the present system of school organisation.

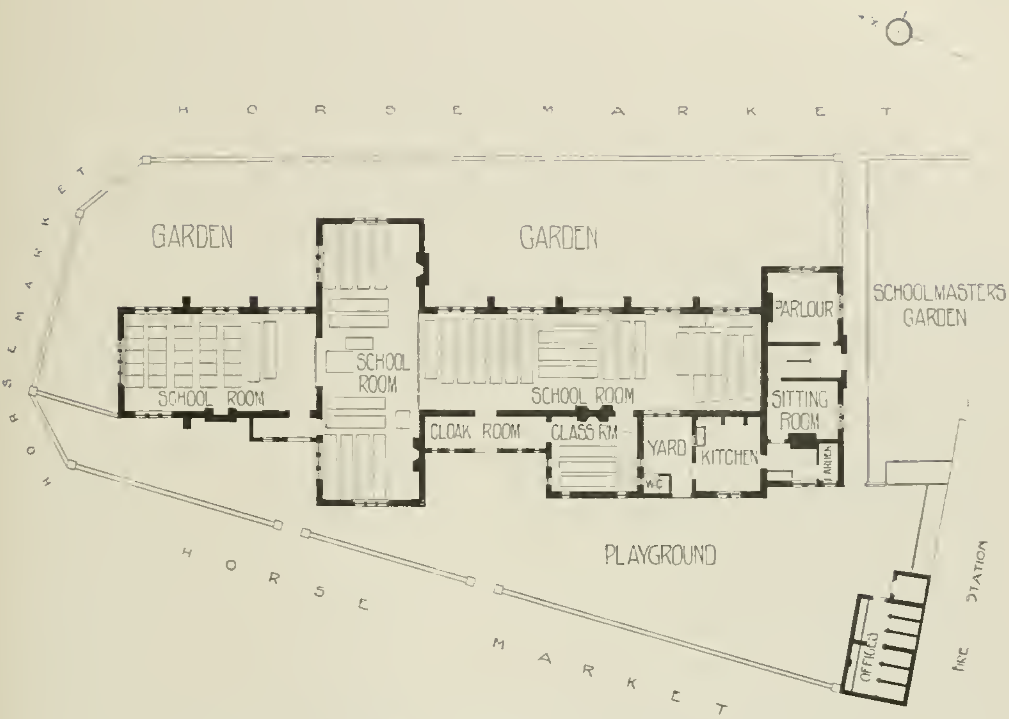
Obviously, the arrangement of teaching a number of large classes in one room cannot be allowed to continue. To divide up the room at once raises the question of accommodation. The school will have been

recognised by the Board of Education as providing sufficient space for a certain number. This number will have been arrived at by taking the whole area of the rooms used for teaching, and the number the building will accommodate found by allowing 8 square feet of floor space for each scholar. Such a method of calculation in the case of a large room results in a number considerably in excess of that for which the room can be conveniently arranged. The division of such a room, by means of partitions or otherwise, and the proper rearrangement of desks with regard to the lighting, &c., will necessarily effect a large reduction in the numbers that the school will accommodate. The managers as a rule will be very unwilling to agree to any diminution in the size of their school, and not unnaturally object to expending perhaps a considerable sum of money, when the net result of the alterations will be a considerably decreased school. Of course, where the site is sufficiently large, additional class-rooms will form part of the alterations. But it should be clearly understood that the probability of effecting any real improvement, without a very substantial decrease in the numbers, is a very small one.

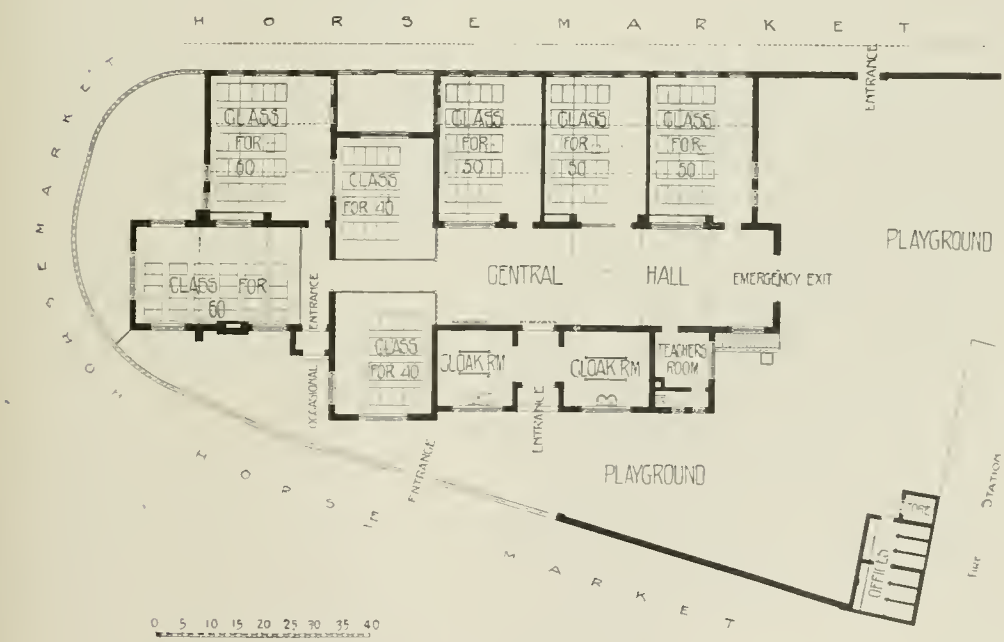
The first essential in a school of any size is to ensure the provision of a separate room for each class. It is not only unfair to the teachers, from an educational point of view, to expect them to teach in a room where several large classes are taught together, but seriously detrimental to their health.

In certain cases it may be possible simply to divide up the large room into class-rooms of the requisite size, but considerable care is required to do this in a way that will produce satisfactory results. The positions and size of the existing windows must be fully taken into account, and, unless the building is already heated by hot water, additional means of warming are almost certain to be required, as the fireplaces or stoves are unlikely to suit the wished-for divisions of the room.

A further difficulty that usually presents itself will be found in the fact that by simply dividing the large room by cross partitions certain class-rooms are forced to become passage-rooms to those beyond. This is a serious inconvenience, and must be met either by taking the space necessary for a corridor from the width of the room or by building one on the outside. Probably the most satisfactory method of dealing with an old school occurs in cases where it is possible to simply utilise the old large room as a central hall and build on the necessary class-rooms opening off it. This is well illustrated in the accompanying example of the Boys' National School, Kettering (Figs. 400 and 401).



400. THE BOYS' NATIONAL SCHOOL, KETTERING. Plan as existing.



401. THE BOYS' NATIONAL SCHOOL, KETTERING. Plan as remodelled.

T. J. Blackwell, Architect.

Fig. 400 shows what may fairly be considered a typical example of an old country school. The main room is long, inconveniently narrow, and, crowded up with desks. The one class-room that exists is too small, the cloak-room space is quite inadequate, and the access to the various parts of the school is in many cases through other rooms. Fig. 401 shows the school remodelled. The Master's house has been swept away, and the garden belonging to it thrown into the playground. The old schoolroom has been cleared of desks and converted into a hall, giving convenient access to a row of class-rooms and providing a way into the further rooms. The class-room, too small for teaching purposes, has been converted into a cloak-room. The cost of these alterations was rather over £2,000.

The possibility of keeping a sufficient space clear for the purpose of drill, physical exercises, assembling the school, &c., should be carefully kept in mind. Additional class-rooms that have to be added must be so arranged that there is easy access to them without causing disturbance to any part of the school. They must be so arranged that the Head Teacher can exercise supervision over them without undue trouble and not scattered about wherever one can be got in. A department should be confined to one floor.

The entrances and exits, and, if the building is of more than one storey, the staircases, must be carefully considered from the point of view of rapidly emptying the building in case of fire or panic. If there is a department much over 200 on an upstair floor, a second staircase, if not already existing, should be supplied. This can, if necessary, take the form of a suitably arranged outside iron staircase, and it should not be less than 3 ft. wide.

The cloak-room accommodation will be probably inadequate, and adequate addition will be required. It will often be found that these old schools possess one or two class-rooms too dark or too small to be used for teaching purposes that can be converted to serve this purpose, or else can be turned into a room for the teaching staff, for whom some provision must be provided.

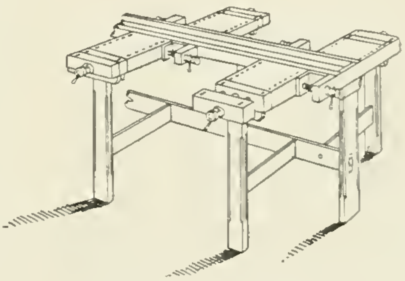
The offices will of course receive careful attention in the light of modern principles of sanitation, the result of which usually shows the necessity of rebuilding them at a suitable distance from the school. The proper treatment of these is, except in the case of schools with no playground, a comparatively easy and simple matter.

Chapter XXIV.

MANUAL TRAINING ROOMS.

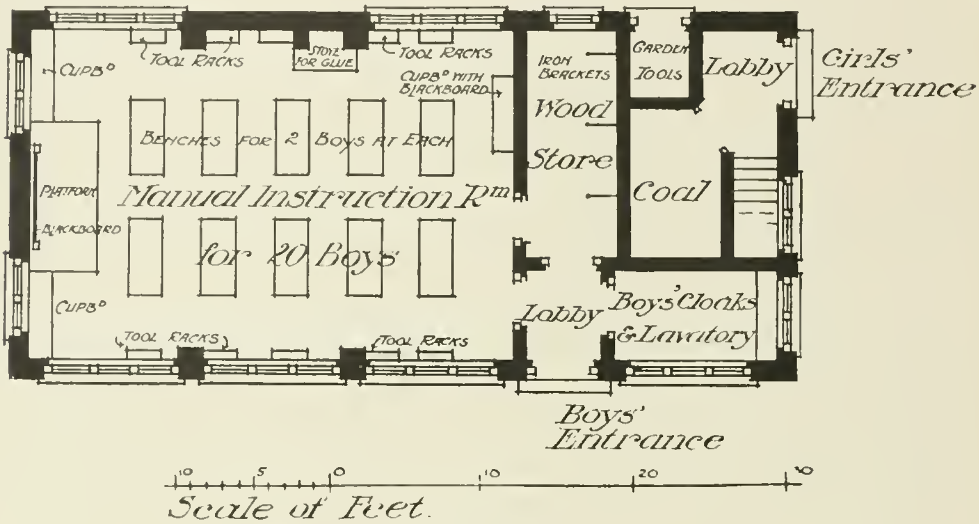
Centres for Manual Training—Examples of—Slöjd Rooms—Arrangement of Benches—Cookery Rooms—Laundry and Domestic Economy Centres.

The provision of a room suitably fitted for carpentry and manual training is usually regarded as a necessary part of a large school, while increasing efforts are being made to give opportunities of this sort of work for smaller schools and schools in the country, by providing at suitable places centres to which children can come from neighbouring schools. This can be managed more or less satisfactorily in the case of schools in towns, but in country places where the schools lie far apart and the children are widely distributed it is a matter of considerable difficulty. In Scandinavia and Denmark manual training by means of Slöjd work is looked upon as almost as important a part of the work as the intellectual teaching, and it is rare to find a school, even quite a small country school, that is unprovided with its Slöjd room. Not infrequently it happens that the area supplied for this is often equal to or greater than that of the class-rooms, see for example Fig. 375 (11). There is no need for any elaborate arrangement of building, and the room may well be arranged rather as a workshop than as a schoolroom. The lighting must be carefully attended to and ample glass space provided. The windows may conveniently be placed on each side of the room, so that the working benches can be placed at right angles to the light. The most convenient form is a long narrow room in which two rows of benches can be placed. In this way the teacher can keep all the class well under observation, while all the workers can see the blackboard at the end, in case the teacher desire to give any explanations. The benches are usually arranged so that two boys can work at each.



402. Bench used for Slöjd Work.

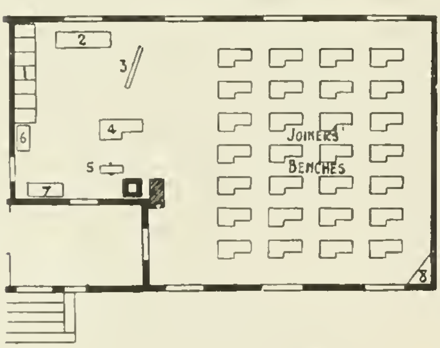
Near each bench must be placed a tool rack. These can either be placed on the wall opposite the end of each bench (see Fig. 403), or on double stands down the centre of the room. The former plan is probably the



403. Manual Instruction Room for 20 Boys.

Jarvis & Richards,
Architects to the Surrey County Council.

more convenient, as it interferes less with movement. Cupboards must be provided both for finished work and for models, also a convenient place for the storage of wood. Where the room is intended to be used by children attending from neighbouring contributory schools a small cloak-room must be arranged.



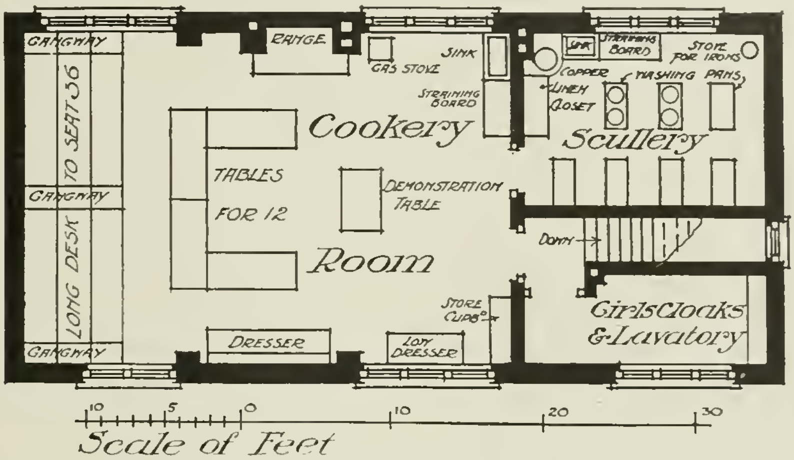
404. Room for Slöjd Work.

1. Cupboard for Finished Work.
2. Turning Lathe.
3. Blackboard.
4. Teacher's Bench.
5. Grindstone.
6. Tool Cupboard.
7. Model Cupboard.
8. Cupboard.

A useful form of bench used for Slöjd work is shown in Fig. 402. The benches should be from 4 ft. 6 in. to 5 ft. in length and about 2 ft. in width. The benches should be at least 4 ft. 6 in. from the wall, leaving a space between each bench and the one in front of 2 ft. 3 in. Where the tool racks are placed on the side walls it is not necessary to allow more than 2 ft. 6 in. for the gangway down the centre. If the arrangement of centre tool racks be adopted, there should be a space of 5 ft. in the middle, while the space between

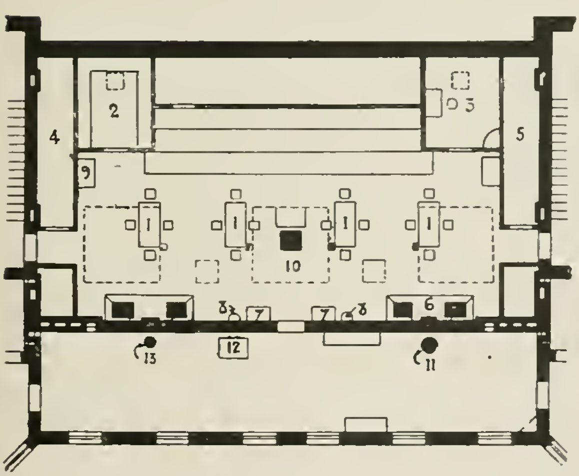
the ends of the benches and the walls can be correspondingly decreased. Adequate space for the teacher must be left at one end of the room.

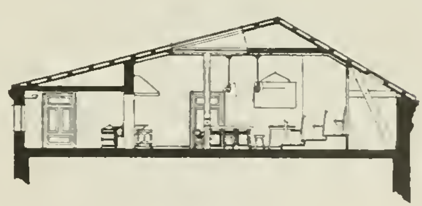
Generally speaking, it will be found that a convenient arrangement of benches, &c., requires about 35 sq. ft. per head, and that a



405. A Cookery Room.

Jarvis & Richards,
Architects to the Surrey County Council Education Committee.





Section.

406, 407. Plan of a German Cookery Room.

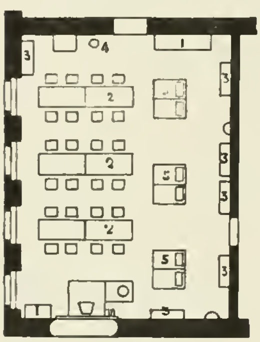
From "Schulhygiene," Burgerstein and Netoletsky.

1. Work Tables, with Stools.
2. Larder.
3. Office.
4. Vegetables.
5. Wood and Coal.
6. Ranges.
7. Washing Tables.
8. Basins.
9. Tables.
10. Demonstration Table, with Gas Stove.
11. Copper.
12. Mangle.
13. Hot Water.

room with two rows of benches will require a width of about 22 ft. In Fig. 403 is shown a manual instruction room for 20 boys, designed by Messrs Jarvis & Richards, architects to the Surrey County Council Education Committee. This is intended to be a two-storeyed building placed in the playground, the cookery-room illustrated below being placed over it, hence the provision of a second entrance for girls.

In Fig. 404 is shown a room as arranged for teaching a class Slöjd work. In this case each boy has a bench to himself, and as they all face the same way it is easy for the whole class to watch a demonstration. A large open space is provided for the teacher, who is provided with a special bench. The various cupboards, &c., are carefully set out.

Cookery-rooms, as a rule, take the place in Girls' Schools occupied by that of the manual training room in the Boys' School, although in certain seaport towns boys are taught cooking in order to qualify for the post of ship's cook. A cookery-room is generally arranged so that it can be used to give a demonstration lesson to a considerable number of children at once and also serve for a smaller number at practical work. A room to take 18 children at actual practice and also to provide room to give a demonstration to a class of 54, will, the regulations of the Board of Education suggest, require an area of not less than 750 sq. ft., and should further have 10,500 cubic ft. There should always be a lavatory attached, and, if the room is to be used as a centre for other schools, a cloak-room. As scullery work forms a necessary part of the training, a sink should be provided in full view of the class and ample provision made for practical scullery work.



408. A Cookery Room.

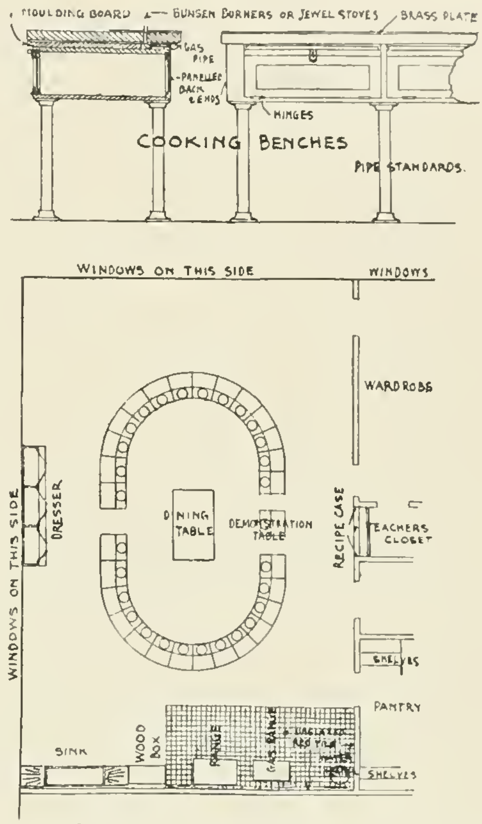
1. Cupboard.
2. Tables, with Stools.
3. Dressers.
4. Chopping Block.
5. Ranges.

Fig. 405 shows a cookery-room arranged for a class of 12 at practical work, with desks arranged at one end of the room, where a lesson can be given to a class of 36. When a gas stove is used, there should be a hood over and a proper pipe to carry off the fumes; but there should be in every case an ordinary range as well. In some of the German Schools there are very elaborately arranged rooms for the teaching of cookery. In that shown in Figs. 406, 407 there are larders provided; four tables, each intended for 4 pupils, each of whom is provided with a stool. In the centre of the room is placed a demonstration table, fitted with a gas stove, facing three rows of seats in rising

tiers. The room is lighted from the top. The section in Fig. 407 will make the arrangement clear.

A somewhat differently arranged room is given in Fig. 408, also a German School. In this case there is no provision made for giving a demonstration lesson except to the pupils in their places at the tables. Each worker is provided with a stool, as will usually be found in the Continental Schools. There are six ranges provided, so that, as the room is intended for 24 pupils, there will be a range for every four.

Fig. 409 shows a cookery-room from a Boston School, in which twenty-four work-benches are arranged in the form of an ellipse, a dining-room table being placed in the centre. Each work-bench is fitted with a compartment for utensils, bread board, &c., with gas stoves on brass plates. One bench is detached and arranged as a demonstration table. A range with a sink close by is placed at one end of the room. Cloak-rooms, pantry-room for the teacher, &c., are provided.



409. A Cookery Room from an American School.

From the Annual Report of the Boston Schoolhouse Department, 1904.

Laundry-rooms are often provided in connection with cookery centres. A small room for this purpose is shown in Fig. 405. The tables should allow not less than 3 ft. for each child for ironing. The ventilation of such rooms will of course require special care in order to get rid of the steam. Rooms for the teaching of domestic economy are also often provided, in which, as far as possible, the arrangements of a small house are followed.

PART III.

THE HYGIENE OF SCHOOLS.

PART III. THE HYGIENE OF SCHOOLS.

Chapter XXV.

VENTILATION AND HEATING.

Difficulty and Importance of Subject—**Ventilation**—Ventilated and Unventilated Schools—Necessity of Knowledge upon the part of the Teachers—Composition of Air—Causes of Vitiation—Dust—Amount of Air necessary—The Size of Rooms in reference to their Ventilation—The Circulation of Air in a Room—Different Systems of Ventilation—Downward and Natural Methods—Comparison of the two—Inlets and Outlets, their Size and Position—Tobin's Tubes—Figures showing Behaviour of Air according to Position of Inlets and Outlets—Size of Openings—**Heating**—Temperature for Class-rooms—Different Methods of Heating—Grates—Stoves—Radiators—Warming by the Admission of Hot Air, Reasons against—Methods for Controlling the Heat—Description of the Plenum System—Conclusions as to the Ventilation of Large Buildings and of Small Schools—Ventilation by Windows only.

Schools are an extremely difficult class of building for which to supply ventilation and warming that shall be efficient and reasonably economical. The rooms are usually many in number, differ considerably in character—from class-rooms to laboratories and large halls—and have a continually varying number of occupants. At the same time the importance of proper and effective ventilation cannot be overrated. It is hardly too much to say that the success of a school, educationally as well as physically, will to a considerable extent be dependent upon the efficiency of the ventilation and heating.

The lassitude and lack of interest, the inability to concentrate the attention, and the loss of energetic mental application, due to working in a vitiated air, are too well known to require any repetition here. Yet in spite of the denunciation of writers on hygiene, and the continual discussions of the subject, the state of the air in schools is usually very far from what it should be: expense as well as the difficulty has no doubt a good deal to do with this. But, as Dr Newsholme remarks—"Although pure warmed air mechanically propelled into schoolrooms

costs money, it repays the additional expenditure in improved health and power of work. Dr Wheatly states that at Blackburn a large manufacturer by adequately ventilating his weaving sheds increased his output $2\frac{3}{4}$ per cent. Dr Carnelly's well-known report mentions the fact that among 9 mechanically ventilated schools the average Government grant earned per head was 21s., among 95 naturally ventilated * or unventilated schools it was only 18s. $3\frac{1}{4}$d. ; and a portion at least of the explanation of the differences in grant-earning power of the contrasted schools lies in the proved excessive impurity of the air in the latter." †

If some such difference were conclusively proved to be the direct result of improving the ventilation, it would be an interesting calculation to work out as to whether it would not be actually a good investment, from the money point of view alone, for school managers to ventilate their schools effectually.

Probably one of the great hindrances to a more universal insistence on the proper ventilation of rooms lies to a large extent in the fact that the deterioration in the air is invisible, and for a long time imperceptible to the persons using the room. A room which appears excessively stuffy and close to a person coming in from outside may seem quite comfortable to those actually in it ; and also that the bad effects, although directly due to the use of badly ventilated rooms, are usually attributed to other causes, unless the conditions are so bad as to produce immediate headache or discomfort.

The colds and coughs common in schools, which are usually attributed to draughts, are probably much more due to the lack of them. A window opened suddenly in a hot and crowded room is of course a source of great danger, but, provided that the air is fresh and the custom of keeping the windows open is begun in the summer, it will be found possible to keep the windows open nearly all the year round in this climate. In the open-air cure for consumption the windows are usually removed altogether, so that there should not be anything so very dangerous to persons in health in an open window, provided they are warmly clad. It should be remembered, too, that the dangerous form of draught is caused by a small opening into a warm room, which causes the air to enter at a great pace, so that a

* It is only fair to note in these comparisons that the expression "naturally" ventilated schools usually means buildings in which no precautions have been taken for ventilation at all, or, at the best, those in which a few inlet tubes have been supplied.

† Paper read to Sanitary Institute, June 1900, "The Healthy Scholar."

widely opened window is not only safer, but often prevents the feeling of draught.

"It seems to be important in the case of class-rooms to maintain a rather high and even temperature, else one would suggest that in the smaller schools, especially in the country, all the windows on one side, or even the whole of one wall, might be removed, and the children keep themselves warm with extra clothing." * Without going quite so far as that, it may be worth while pointing out that the high temperature required in class-rooms is usually due to lack of ventilation. A feeling of chilliness is felt when there is a certain degree of impurity in the air, in a temperature that seems comfortably warm with a proper supply of oxygen. While it is no doubt true that the cold air or draught is the actual inciting cause of colds, &c., it is the loss of the power of resistance due to impaired vitality caused by sitting in ill-ventilated and often overheated rooms that renders the victims such an easy prey.

It is curious to reflect on the reliance which is placed on the power of the cracks under the doors and the crevices round the windows. It has been estimated that in an ordinary class-room all the occupants would be dead in about half an hour were all opportunities for ingress of air hermetically sealed up.†

A great step will have been gained when it is more fully recognised that although there may be some risk in open there is undoubtedly more in shut windows, unless some other means for the provision of fresh air are provided. But until there is a strong public feeling on the subject it is not likely that much will be done. As the late Sir Douglas Galton said—"If the opinion was only equally spread through the community that bad air was detrimental to health, if the fact that a room being close and stuffy was regarded as disgraceful, if people refused to attend dinner parties where the rooms were filled with bad air, the architects, the builders, and the occupiers would soon find means that every room should be pure and of a comfortable temperature."‡

An interesting and instructive incident is mentioned in a small handbook on ventilation, by the late Professor Jacob.§ In some French cavalry stables the mortality of the horses was reduced from 197 to 20 per 1,000 by simple ventilation. Again, to quote from Major Fisher ||—"A horse seldom takes a 'cold' from exposure to cold,

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* *The Edinburgh Review*, The Fight against Consumption, October 1901.

† Ventilation of School Buildings, p. 12, G. Morrison.

‡ Healthy Dwellings.

§ Ventilation and Warming.

|| Through the Stable and Saddle-Room.

but frequently is made ill from being too warm. It is the *inside* not the outside air that gives them coughs, sore throats, congestion of the lungs, and sundry other ills to which horse flesh is heir." If we substitute human for horse flesh, these remarks will lose none of their force.

It has been thought well to discuss somewhat in detail the elementary principles underlying the different systems and methods of ventilation, in the hope that it may be of use to some of those teachers who, having had no opportunity of making themselves acquainted with the subject, are so very apt, either from carelessness or in the hope of improving the state of things in their class-rooms, to spoil or render quite useless any provisions that may have been made for the purpose of ventilation.*

No scheme will ensure the proper warming and ventilation of a building unless it be intelligently used. Tobin tubes or other ventilators may be supplied, but they will be found to be usually closed, and commonly used for the purpose of a waste-paper basket. It is, however, only fair to add that a badly arranged inlet may cause such unpleasant draughts that any means to stop it are justifiable.

The Composition of Air.—Pure air, before being breathed, consists of about 21 parts of oxygen to 79 of nitrogen in 100, some watery vapour, a trace of ammonia and carbonic acid to the proportion of 4 parts in 10,000. Expired air contains about 5 per cent. less oxygen, and carbonic acid in the greatly increased proportion of 470 parts in 10,000, and is also raised in temperature to nearly the heat of the body, viz., 98°, and is saturated with moisture.

Carbonic acid is a heavy gas, and will, if allowed sufficient time, mix uniformly with the air. It is, however, quite fallacious to assume on

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* An incident which happened within the writer's knowledge will illustrate this. In a certain class-room, which was a room in an ordinary dwelling-house converted to school use, having three doors and warmed by an open fireplace, two Sherringham ventilators had been placed for the admission of air. One morning, the weather turning cold, these were shut, and, a draught being felt from the doors, two which were not absolutely necessary were fastened up, being finally, as the draughts got worse, pasted completely over. When this was done the draught from the remaining door to the fire was unbearable, and such strong complaints were made that the advice of an expert was obtained. The remedy was as easy as the explanation was obvious. By opening the ventilators wide, and lighting the fire in good time in the morning, the difficulties both of warmth and draughts were settled. The fire, being able to draw its necessary supply of air from various points, was no longer forced to draw a strong current from the only available source, the door.

this ground, as is sometimes done, that the bad air in a room will be found near the floor. On the contrary, the expired air, although heavier than air at the same temperature, is raised by breathing to a warmth so much in excess of that of the surrounding air that it rapidly rises and then begins to diffuse itself evenly through the room. This is indeed a matter of common observation, for instance, when going into a gallery or upper part of a crowded hall ; but it is a fact not infrequently lost sight of. Carbonic acid or carbon dioxide is not itself an actually poisonous gas, and death would ensue if a person were placed in an atmosphere containing this gas in too large a proportion, merely from want of the necessary oxygen. There is among physiologists no decided agreement as to exactly what impurity in the air should be attributed to the deleterious effects of crowded rooms. But whether the effects are to be attributed to the organic impurities in expired air, which certainly have a perceptible and disagreeable odour, or to the excess of carbonic acid, or simply the lack of sufficient oxygen, there is no doubt of the evil results arising from overcrowded, ill-ventilated rooms, and the term "crowd poison" has been used to denote this. In order to test the purity of the air it is customary to estimate the proportion of carbonic acid, as this will at once show to what extent the air has been breathed, and this may be considered a fair test of other impurities ; as it has often been shown by different investigators that the organic impurity in the air increases in a constant proportion with that of carbon dioxide. So that, knowing the amount of carbonic acid present in the air, we shall have a quite sufficiently accurate idea of its condition. Authorities differ as to the greatest amount of carbon dioxide that ought to be permitted. It is quite certain that no unpleasant sensation is experienced until the amount is increased to 10 or 12 parts in 10,000, yet authorities are generally agreed that the maximum amount should not exceed 10 parts in 10,000. The standard of good ventilation usually adopted at present would permit about 6 to 8 parts in 10,000 in the air.*

The amount found in the air in the open country is from 3 to 5 parts per 10,000, and it is usually reckoned as 4 for the purpose of a standard measurement.†

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* Heating and Ventilating Buildings, Carpenter, p. 26.

† A simple plan for estimating roughly the proportion of carbon dioxide may be of use :—

Six stoppered bottles are taken, containing respectively 450, 350, 300, 250, 200, 100 cubic centimetres. These are filled with the air of the room which is to be tested by means of a small handball syringe. A pipette, holding exactly 15 cubic centimetres, is then filled

Other Causes of Vitiation.—Besides the rise in temperature caused by a number of persons crowded together, from the expired air and the heat thrown off by the body, there is a constant accumulation of water vapour, and the sense of discomfort and oppression felt in a crowd is probably in a great measure due to the latter; the undue proportion of moisture in the air, by preventing the proper evaporation from the surface of the body, deranges the action of the skin, and when evaporation is retarded to a sufficient extent a rise of internal temperature succeeds. It is generally observed that cases of sunstroke occur in the greatest number where there is combined with great heat a high degree of humidity in the air. Dr Billings suggests that the great difference in the standard of temperature * at which rooms are kept in this country and in those in America may be to a certain extent due to the much greater dryness of the air in the latter country, as well as to custom and habit.

In addition to carbonic acid, organic matter, and moisture from the results of breathing, and the water in organic salts and fatty acids given off by the skin, there are other factors which play a part in vitiating the air, among the most important of which may be considered dust. In school buildings, from the great amount of movement, dust is one of the most serious and difficult problems to deal with successfully. It rises in great quantities from the floors of the class-rooms, it is kicked up in the corridors, and finds resting-places in the joints of the woodwork, floors, and corners till stirred up again. To these particles of dust are attached floating bacteria in considerable quantities, and, while not all these bacteria by any means are injurious, there is probably a

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with clear transparent lime water, emptied into the smallest bottle, and well shaken. If the fluid becomes turbid, the amount of carbonic acid will be at least 16 parts in 10,000. If there is no result with the smallest bottle, the next is tried, the results being shown as follows:—

If the	100	cubic	centimetre	bottle	becomes	turbid,	16	parts	in 10,000.
,,	200	,,	,,	,,	,,	,,	12	,,	,,
,,	250	,,	,,	,,	,,	,,	10	,,	,,
,,	300	,,	,,	,,	,,	,,	8	,,	,,
,,	350	,,	,,	,,	,,	,,	7	,,	,,
,,	450	,,	,,	,,	,,	,,	6	,,	,,

In order to judge of the turbidity, mark a piece of paper with a lead pencil and gum it to the bottle with the mark inwards. If there be turbidity the mark will be invisible. This is of course only a rough test, but one which can very easily be tried, and which is sufficiently accurate for ordinary purposes.

* See *post*, page 445. The standard temperature for class-rooms in America is usually given as 70°.

certain proportion which consist of the germs of diphtheria, tuberculosis, &c. The difference in the number of germs found in well-ventilated rooms compared with those not so well arranged is very striking. For instance, Professor Carnelly gives the following results of his examination in Aberdeen and Dundee.* In the first town he examined 42 "naturally" ventilated schools, *i.e.*, without special apparatus, and found the number of micro-organisms per litre to be 136, and in 39 similar schools in Dundee the number was 152. On the other hand, in the 12 mechanically ventilated schools in Aberdeen and 25 in Dundee, also examined, the numbers were 20 and 17 per litre respectively.

Another cause of the deterioration of the air occurs in the use of various forms of artificial illumination. These have been already treated at length.† There is also during combustions of oil or gas a certain amount of carbon monoxide given off, which, in distinction to carbon dioxide, is an actually poisonous gas, so that considerably more provision for ventilation is necessary for rooms that are to be used for night as well as day work. Gas burners are usually reckoned as equal to five persons in estimating the amount of air required for ventilation.‡

Standard of Purity required.—The amount of carbonic acid that may be allowed in rooms without any injurious effects or perceptible odours is generally reckoned as 6 parts in 10,000, that is, .0002 in excess of that in ordinary country air. On this amount there is a fairly general agreement. A fair average of the CO_2 given off is for adult males, 0.6 to 0.7 cub. ft. per hour; females, 0.4 to 0.5. Parkes adopts 0.6 cub. ft. per hour as an average for mixed assemblies. Dividing the limit of permissible impurity by the amount of carbonic acid exhaled in an hour, we have $\frac{0.6}{0.0002}$, giving 3,000 as the amount of cubic feet of air required per hour per person, and this is the standard usually adopted. This is, however, rather in excess of what is necessary for school children, and Dr Billings, in his book on "Ventilation and Heating," gives 2,400 per head per hour as the amount that should be allowed. It should be noted that this is on the understanding that the effects of respiration are not carried off directly, but merely mixed with the air, which requires dilution by the addition of so much fresh

* Conspectus of the Air in 85 Schools, by Professor Carnelly (*Journal of Pathology*, November 1893), quoted by Professor Jacob in "The Ventilation of Buildings."

† Page 89, The Artificial Lighting of Class-rooms.

‡ Heating and Ventilating Buildings, Carpenter, p. 2.

air. When the vitiated air is carried straight off, a very much smaller supply of air would be sufficient, having been fixed as low as 1,000.

But even when the downward system of ventilation is used, in which the foul air is carried off at the bottom, fair ventilation can be obtained with less than the 2,400 cub. ft. The Massachusetts law requires 1,800 cub. ft. per hour per pupil, and where this standard is maintained there will certainly be no perceptible effects of want of ventilation. Taking then a class-room 25 by 30 ft. and 13 ft. high, and containing 40 pupils, the air would have to be completely changed once in about 8 minutes, or, allowing that the air is changed once an hour by natural ventilation through the wall, crevices, &c., once in 9.6 minutes. Hittenkofer found that a room in which all the windows and crevices had been closely pasted up, when there was a difference of 40° between the inside and outside temperature, that the change of air by diffusion through the walls amounted to 7 cub. ft. per hour for each square yard of wall surface.* This form of ventilation is too uncertain in amount and character to be reckoned in calculating the amount of air required for ventilation.

The Size of the Room.—The cubic capacity of the room and its shape have of course a considerable influence on the question of its ventilation, but this influence is often overestimated, and even in a large room, if no fresh air is supplied, the atmosphere will quickly fall below the standard of purity desirable. One of the commonest fallacies in regard to ventilation is that a high room is necessarily better ventilated, and that if the requisite amount of cubic space be made up in height all will be well. As a matter of fact, this is not in any degree the case. The additional height that is often provided in class-rooms, while considerably increasing the cost of the building and the length of the stairs, is, as far as ventilation is concerned, not only a complete waste of space, but considerably adds to the difficulty of both warming and ventilating the room. As Dr Billings, whose opinion is naturally of great weight, remarks, "In computing space for purpose of ventilation, heights of rooms above 12 ft. should be disregarded."† In fact, the only advantage of making class-rooms of a greater height is for the purpose of effectively lighting the side farthest from the window, when of sufficient breadth to require it. Large rooms, *i.e.*, in the sense of a large superficial area per head, are of course easier to ventilate, more air can be admitted and at a greater pace without causing any

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* Carpenter, p. 35. † Heating and Ventilation, p. 135.

inconvenience from draught, as it is generally possible to arrange that the inlets shall be at a sufficient distance from the nearest seats. But it is as well to bear in mind that the size of the room will make very little difference with regard to the necessity of providing for the admission of fresh air or to the amount to be supplied. The following table, which is often quoted, shows the time it takes to reduce the air in a room to a condition in which it contains 12 parts of carbon dioxide in 10,000. The figures are of course only approximate, since air is always entering more or less through cracks and crevices.

Class of Building.	Cubic Capacity per Head.	Time required to contaminate the Air.
Hospital - -	1,200 cub. ft. and above.	70 minutes.
Middle-class House -	1,000 ,, ,,	59 ,,
Barracks - -	600 ,, ,,	35 ,,
Good Secondary Schools	260 ,,	16 ,,
Elementary Schools -	130 ,,	8 ,,

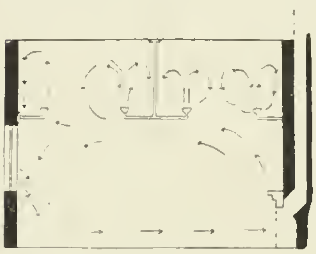
This is allowing in the case of Secondary Schools 20 sq. ft. per head, presuming the rooms to be 13 ft. high; in the Elementary 10 sq. ft., as laid down by the regulation of the Board of Education.

It would be well that this should be borne in mind when the question of class-room accommodation is under consideration, for, were the extra expenditure so often incurred by giving a lavish allowance of floor space devoted to the provision of more effective means of ventilation, the result would often prove more satisfactory.

The Circulation of Air in a Room.—It is not possible to show with any accuracy the line taken by the air entering a room, and so follow its course through from the inlet to the outlet. Innumerable eddies and cross currents are set up by local sources of heat, or by friction against obstacles, while the diffusion of the incoming air with that in the room rapidly destroys any line of demarcation. In a close room heated by hot-water pipes there is a continual circulation of air, but the movement is of course confined to the same air, so that the conditions will soon become very bad. In an ordinary room heated by an open fire, with fresh air entering either by open windows or through inlet tubes or the crack and crevices left in the closed door and windows, the general circulation will consist of a rapid entering current of cold air at the inlets with an equally rapid movement out up the chimney, with a cold layer of air from 1 to 2 ft. thick moving towards the fire, which will be affected by the various objects warmed by radiation from the

fire. In the case of a similar room with a number of gas jets fixed at the same level, as in a class-room, there are as it were three nearly independent planes of circulation. The heat of the gas jets sets up a strong local circulation which does not extend below the plane of the jets. The movement is shown approximately in Fig. 410. The air above the line of gas jets would be very bad, while the best air would be that nearest the floor. Where the admitted air is of the same temperature as that in the room, it merely diffuses itself without taking any particular direction.

Different Forms of Ventilation.—In order to secure ventilation of any kind, provision must be made first for some power to keep the air in motion; and secondly, for sufficient inlets for the admission of fresh air, with corresponding outlets for the escape of the vitiated air. The movement of the air can be produced either by the expansion due to heating, or mechanically by the use of fans. In the first case the movement is due simply to the difference in weight between hot and cold air. The former, being lighter, rises and flows out of one set of flues, its place being taken by colder air coming in at the bottom. This is known usually as the "natural" or "gravity" system.



410. Showing Circulation of Air, after Shaw.

A fact that seems often lost sight of is that the system of ventilation has to provide for the effective change of the air under two almost opposite conditions—in winter, when the outside air is at a lower temperature than that inside the building, and in summer when the conditions are reversed. In some of the more recently erected schools in Switzerland the engineers have provided a double set of extract openings. The difficulty of summer ventilation can be easily met in this country by having a plentiful supply of windows that open, and means of establishing through currents of air.

Mechanical ventilation by means of fans is performed in two ways, by pressure and by suction. In the former, the air, being forced into the rooms under pressure, escapes naturally in the direction of least resistance, that is, outwards to the atmosphere; in the latter the fans are used to draw out the inside air, and so induce a current of air from outside to supply its place. These systems are known as the "Plenum" and "vacuum" systems respectively. Sometimes a combination of the two is successfully used. In both cases, when mechanical ventilation is used, the air is moved without any reference to change of temperature,

and the force used must be sufficient to overcome any disturbance due to this cause or to wind. There are certain objections brought against the "vacuum" or exhaust system. When used alone, it is difficult to control the movements of the vitiated air. The opening of a window, a door, or a badly-fitting window in one room, will upset the ventilation all over the building, since the supply of air to the exhaust fans will naturally come from the place whence it can be drawn most easily. Another grave objection has been occasionally found—the air may be drawn in through the water-closets and lavatories, giving rise to unpleasantness and to serious danger when there is any defective plumbing work. As Mr Wheelwright, the writer of a recent book in America on School Building, says—"In more recently constructed schools the exhaust fan is now rarely used, and then only for special purposes and conditions." *

The two systems then that we have to consider are the "Plenum" † or pressure system, where the pure air is admitted high up and the foul air extracted at the bottom; and the "natural" system, where the vitiated air is taken off through outlets arranged at the highest part of the rooms, the fresh air being introduced at a moderate height or at the floor level. There is a very great difference of opinion as to the relative merits of the two methods. It will be as well to briefly state some of the chief arguments usually advanced in favour of each system. In order to make the comparison in any degree a fair one, it is necessary to assume that in either case the incoming air is warmed, at any rate sufficiently to prevent its causing an unpleasant feeling of draught. To compare, as is so often done, a method which brings in warmed air with a system which only provides for the admission of cold air, in which case the ventilators are certain to be closed in winter, is manifestly unfair; and it is just as easy to provide that the supply of air shall be warm in the case of the upward or natural system, provided that it is of a lower temperature than the air already in the room, as it is in the case of the downward or pressure system. Probably no small part of the credit which the "Plenum" system has acquired is due to the continually published tables comparing the results obtained by that system with those in what are called naturally ventilated schools, but which should be called schools with no provision for ventilation, even though there may be a few Tobin tubes supplied. It would be in-

* School Architecture, p. 264.

† For description, actual arrangement, and practical working of this system, see below, page 452.

teresting to see tables showing the comparative results of a well-arranged system of "natural ventilation" and the Plenum system.

For the natural or upward system of ventilation it is contended that as the vitiated respired air is of a considerably higher temperature than that of the surrounding air, it rises at once, and so should be taken off at the top, while in the downward or pressure system, the pure air being introduced at the top, the air that has already been breathed is forced down again past the heads of those sitting in the room, though of course in a much diluted form, and so breathed again. Those sitting near the outlets are in a continual stream of bad air, as the downward action cannot be of sufficient strength to prevent the expired air rising at all without causing an intolerable draught. Again, in case of a room illumined by any form of artificial light, other than electric lamps, the heat helps to strongly increase the upward current, and so helps to carry its own noxious fumes away. On the other hand, with the downward system the unpleasant products of combustion have all to be carried downwards past the persons sitting below, unless some special and rather elaborate arrangements are made in the lighting apparatus.

It is further argued that with a downward propulsion of air perfect ventilation is impossible, as the vitiated air is not at once removed, but diluted ; much on the same lines, it is suggested, as a water supply in which the water was returned to the reservoir after use, but with one that was of a sufficient size to make the impurity scarcely noticeable in the water when used again, while on the upward system the vitiated air is taken away, the fresh air only coming to the people in the room, and being available for breathing. So that in the case of the downward system the amount of air that has to be introduced is very great, since it has to be sufficient in quantity to dilute the air in the room to the degree that is supposed to be harmless. It is usually reckoned that at least three times the amount of air is required for the downward system than is necessary for the proper working of the upward method. In halls arranged with galleries there is great difficulty in so arranging the down currents that the vitiated air from the galleries shall not be breathed again by those in the main body of the hall, or that the fresh incoming air shall not be all drawn away to the galleries.

Further advantages claimed for the natural system are great economy in installation and in working, as nothing is required beyond occasionally cleaning the flues and slightly warming the incoming air, the impossibility of its getting out of order where once fixed from ignorant or careless use, and the avoidance of any necessity for a skilled man to look after it.

The upholders of the downward or pressure system maintain that the natural system, even where assisted by heat in the flues, is unable to maintain the necessary movement in the air, unless under exceptionally favourable conditions of the atmosphere, and that under certain conditions of wind there will be a complete failure of the ventilation, with sometimes strong and unpleasant down-draughts, but that by placing the inlets for fresh air at the ceiling and the extract flues at the floor level a far better circulation of air through the room is obtained, while the opposite arrangement, *i.e.*, the inlet below and the outlet above, will lead generally to a direct current from the inlet to the outlet, leaving large parts of the room unaffected; and that, although in the downward system the air has to be brought down again, it is in so diluted a form that the unpleasantness is not only imperceptible but quite harmless, and, even if this may be considered a slight defect, it should be far outweighed by the very great advantage of a system that will act with certainty under all conditions of weather or temperature. Finally, that the question of cost should not be allowed to have much influence, it being desirable to use the best means for obtaining pure air.

While each system has numerous and strenuous supporters, opinion generally seems turning rather in favour of a combination of the two, *i.e.*, that fresh, slightly warmed air should be propelled into the rooms under very slight pressure through inlets placed at a moderate height and well distributed, the vitiated air being taken off by large outlets high up. In this way it is urged that, while retaining the many obvious advantages of drawing off the bad air at the top, the slight pressure that the air is under will ensure a sufficient movement under all conditions of weather and temperature. Further, that the opening of a window in one room will not interfere with the ventilation all over the building. Two important considerations have to be borne in mind. First, that very great care is necessary in determining the position of the outlets and inlets; and secondly, that the incoming air should be only warmed sufficiently to avoid any unpleasant sensation of draught, and should not be used for the purpose of warming the room.* In the case of many Secondary Schools where the classes are small and the rooms a fair size, in which it is impossible to go to the expense of the installation of any elaborate scheme of ventilation, it is possible by the judicious use of simple means, such as ventilating fireplaces and hopper windows, to obtain quite reasonably good air in the rooms.†

* See below, page 449.

† See below, on ventilation of small schools, page 455.

On the whole, it may, I think, be fairly concluded that in large buildings, where there are great numbers brought together, it is essential to have some form of mechanically worked ventilation ; but that, in order to ensure that such a system will work properly, it is necessary to have a skilled engineer in charge of it, capable of making the necessary alterations and adjustments to meet the varying conditions of the weather ; but that in small establishments, by having a "natural" system installed under the superintendence of a really skilled engineer, and properly arranged, so that once in working order it will require no skilled manipulation, it will be found possible to keep the air in the rooms up to very nearly as good a condition as in the case of a mechanical system, provided that the apparatus is used with intelligence by those in charge of the rooms.

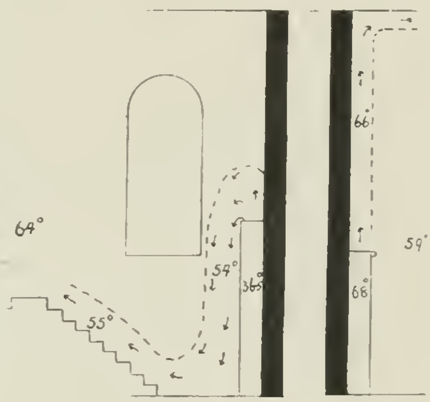
It must not be forgotten that, while no doubt very admirable results may be gained by a properly designed and carefully worked mechanical system, the bad results arising from a badly conceived installation are often worse than none at all ; and as any openings in addition to the regular inlets and outlets will upset the whole scheme, it is not possible to open the windows either during or between lessons, whatever the weather may be. Again, although the apparatus is guaranteed to change the air in the room so many times, and while it can perhaps be shown that it pumps a sufficient quantity of air into the room to do this, it may easily happen, if the inlets and outlets are not properly situated, that the incoming air passes directly from one to the other, while the main bulk of the air in the room remains entirely unaffected.

A great deal of the support and writing in favour of the mechanical systems come from America, where provision has to be made for a much larger range of temperature than is the case in this country. It is not unlikely that the popularity of the Plenum or downward system is to a considerable degree due to the strong support given to it by American writers on ventilation and heating, for, owing to the necessities of the climate, and partly perhaps to their fondness for and great ingenuity in mechanical apparatus, the Americans have devoted far more attention to questions of mechanical heating and ventilation than this country. There has, however, been great readiness to adopt their methods and inventions, which, although they may be suitable or even necessary in America, are not required here to anything like the same degree. The Plenum system, for its proper working, entails the necessity of always keeping the windows shut ; but in a climate like that of England it is only for a short time in the year that it is too cold to

allow of the outer air being brought in at its own temperature, and never perhaps to allow of the windows being opened during a recess when the class-room is temporarily unoccupied,* the result being that for large parts of the year, when air might be allowed to enter freely by the windows, considerable expense is gone to to drive air through ducts and mains, often dusty and dirty, into the class-rooms, while all the windows in the building are kept rigorously closed.

Inlets and Outlets, Size and Position.—The size of an inlet is dependent naturally upon the amount of air to be admitted, and the pace at which it enters. In order to avoid a feeling of draught in the room, it is usually considered that this pace must not exceed 5 or 6 ft. per second. If it is necessary to introduce it at a greater speed, great care must be taken to so arrange the position of the inlet that the draught will not be felt by any one in the room.

The actual direction taken by the air on entering the room can be guided to a considerable extent by the shape of the inlet opening, *i.e.*, it can be given a turn upwards; but at the same time it must not be forgotten that it will behave in very different ways according to the difference between the temperature of the incoming air and that of the air in the room. In Figs. 411, 412 is shown from the results of actual experiments by Shaw† the behaviour of an incoming current of air through an upright tube of the form usually known as a Tobin's tube. In the first case (Fig. 411), the entering air being at a temperature considerably below that in the class-rooms, although entering at a high velocity, almost immediately falls and flows downwards in a cold stream. In the second figure (Fig. 412), the air coming in at a temperature higher than that in the room, rises directly to the ceiling. The first of these two figures is quite sufficient to explain why inlet ventilators of this kind are invariably found shut in cold weather.



411. 412.

Showing the Behaviour of Air Entering a Room through a Tobin's Tube at Different Temperatures.

* It should of course be noted that this method of airing entails a certain waste of heating power, as it allows the room to completely cool down.

† Warming and Ventilation, by Shaw, in "Hygiene and Public Health," Stevenson and Murphy.

An outlet flue should if possible be placed against a warm chimney flue or heated shaft of some kind in order to ensure an upward current. An iron pipe in a chimney is often used successfully. Short tubes projecting horizontally through the wall, which are sometimes put in, in the hope of their acting as outlets, are either quite useless for that purpose, except perhaps in the case of a strong wind from the opposite side of the building, or merely act as additional inlets.

The effect of corners and sharp bends or alterations in the bore of an air duct or flue is often insufficiently appreciated. The carrying capacity of the flue is in this way very seriously reduced owing to the formation of eddies in the corners, which to a large extent restrict the passage of the air. It is reckoned that a corner at a right angle will diminish by 25 per cent. the theoretical carrying capacity of the flue. Air shafts may not uncommonly be found whose effective carrying capacity has been reduced almost to nothing.

413-418.

A plan of ventilation sometimes adopted in halls of carrying the extract tubes into a false roof with openings to the air is not only quite useless, but productive of strong down-draughts.

In the case of warmed fresh air introduced into the room under pressure, it is argued that the best position for the inlet is near the ceiling, on the ground that as the incoming air is warmer than that already in the room it will tend to spread itself over the upper part of the room, and descending gradually will fill the room with fresh air without a draught, while the cooler air can be drawn out at the bottom. In support of this it is usual to find in books on ventilation figures showing a series of tests carried out by Mr Warren R. Briggs * when building the Bridgeport School, U.S.A. (see Figs. 413-418). These

* Modern American School Buildings. 1899.

experiments were carried out in a model one-sixth of the size of the rooms to which the system was ultimately to be applied. The incoming air was mixed with smoke in order that its movement might be visible, and the result shows that, under the conditions of the experiment, undoubtedly the most complete dispersion was obtained where the inlet and outlet are disposed as in Fig. 418.

But although these experiments have been adopted as a very strong argument in favour of the downward system as giving the best and most complete diffusion of the incoming air, and appear, as mentioned above, in most of the recent works on the subject, it is at least open to question as to how far they are of value as a test of the behaviour of air in an actual building. First of all, size itself plays an important part in the behaviour of air movements. Eddies and currents might be set up in a model which would not at all necessarily be found in a full-sized room. The pressure, too, can be controlled when delivering air into a model in a way that would be quite impossible when it has to be supplied to a number of rooms at varying distances and heights. Again, the fact that a number of people expiring air at a considerable temperature (about 98°) would necessarily have a great influence on the result, seems to be neglected. The further influence of the cold air from the window panes and draughts under the doors, and the interference caused by furniture in the room, the occupants themselves and their movements, all seem to have been left out of account. Nor indeed is there any information given as to the difference of temperature in the model and that of the incoming air. So that, on the whole, I cannot think that these experiments have much more than an approximate value as a criterion of the behaviour of the air under the actual conditions of school work.

If a system of heating and ventilation be adopted, as is usual in America, in which the incoming air is heated to a degree sufficient to warm the rooms without any assistance by direct heating, it is of course necessary that the inlet should be above and the outlet below in order to prevent the fresh air being at once carried off by the outlets. The hygienic disadvantages involved in the breathing of air heated in this way are referred to below, page 449.

The State Board of Health of Indiana, U.S.A., has laid down in their regulations referring to the building of schools :—

"All schoolhouses shall take air from outside the building, and after heating introduce it into the schoolroom from a point not less than 6 nor more than 9 ft. from the floor. . . . There shall be ventilating ducts of ample dimensions to carry the foul air from each room, changing the air in each room once in

twenty minutes. Said ducts shall start from a point not to exceed 2 ft. above the floor of the room, and shall be on the same side of the room as the hot-air opening."*

It is as well, if possible, to have more than one inlet. The outlets should also be divided, both for the purpose of avoiding draught, and particularly, in the case of downward ventilation, to avoid having all the vitiated air concentrated at one point, for in that case the person sitting close to the outlet will be in a constant stream of bad air. The outlets should always be at least as large as the inlets, it being probably better to have them larger, even to as great a degree as twice the size.

Size of Openings.—By the regulation of the Board of Education, the inlets, which are to be arranged in corners or positions as far as possible removed from doors or fireplaces, should provide a minimum allowance of area of 2½ sq. in. per head. This hardly appears sufficient unless there is some means of mechanical propulsion in use. It is usually calculated that a square inch of unobstructed space will at the most allow 125 cub. ft. of air to pass through per hour,† so that for every thousand feet of air required 4 sq. in. of clear opening must be provided. Mr Edward Shaw recommends that for a standard American class-room measuring 30 by 25 ft. there should be an opening of at least 4 sq. ft., which, as the room is intended to take 48 pupils, allows 12 sq. in. per head. He goes on to say that 5 or 6 sq. ft. would be probably better.‡ Whatever system of ventilation be adopted, it is of very great importance that the inlets and outlets should be of ample size, especially in the case of natural ventilation where the movement is slow. The little ventilators of perhaps 9 in. by 3 or 6 in. are comparatively useless; it is not until they are so large as to appear almost absurd to the unaccustomed eye that they are of real use. When once the fact has been thoroughly grasped that the larger the opening the less the draught, there will be more demand for sufficiently large openings. Probably more failures are due to the want of size in the openings than to any other cause.

Heating.—The ventilation of a building is naturally dependent to a large extent upon the heating arrangements, so that before considering further the question of ventilation it will be as well to describe

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* The Teaching of Hygiene in the U.S.A. Paper by Miss A. Ravenhill. *Journal of the Sanitary Institute*, April 1902.

† Ventilation and Warming, Jacob. 1894. ‡ School Hygiene, Shaw. 1901.

some of the more common methods used in warming buildings. There is no difficulty in raising the temperature inside a building to any required degree, provided that nothing more is necessary. It is when the heating has to be arranged so as not to interfere with the purity of the air or to help in the ventilation that the question becomes more complicated. It is not uncommon to find, where the heating and ventilation have been arranged for separately, that the heating engineer, having undertaken to supply an apparatus that will raise the temperature in the rooms to an agreed-upon degree of warmth, does so with a boiler of the smallest size that can possibly do the work ; but when it is required to heat rooms that are ventilated, and so has to heat a constant supply of cold air entering, it is quite unequal to the additional strain. As a rule, however, the two are considered together, and naturally the better the ventilation the greater the amount of heating required.

Temperature of Class-rooms.—The temperature at which it is desirable to keep class-rooms is variously estimated by different authorities. The Board of Education require that rooms should be kept somewhere between 56° and 60° Fahr., and, generally speaking, a room that is at 59° or 60° at the opening of school will be found comfortable. In America the regulation temperature is given as 70°. There are probably two reasons for this very high allowance : first, the relatively dry air in which, owing to the rapid evaporation, a higher temperature is required for comfort—it is commonly reckoned that in New York the degree of temperature is required to be about 5° higher than in this country to give the same sensation of warmth ; and secondly, to habit, the custom in America being to heat mechanically nearly all private houses, and keep them up to a high temperature. It is not uncommon to find class-rooms there in the afternoon with the temperature standing at 76° or even 78°. Mr Shaw, an American writer, recommends 65°* as a comfortable and healthy temperature, where the degree of humidity in the air stands at 55 per cent. of saturation. In this country anything above 65° should be considered too high, and even this should scarcely ever be reached, except perhaps at the close of afternoon school, the degree for comfort and health being about 60° to 62°. Complaints of cold are not usually made until the thermometer falls below 56° Fahr. It should not be forgotten that a greater degree of heat is actually required by persons in a badly ventilated room.

* This would correspond to 60° in this country.

The corridors, cloak-rooms, and lavatories, &c., should be kept up to a temperature of about 55°.

The more modern German Schools usually have a glass panel in the wall of the class-room, so that the school-keeper can see the temperature without disturbing the class, and so regulate the apparatus as required, the temperature at which the rooms are required to be kept being from 17° to 20° Cent., or 62° to 68° Fahr.

Methods of Heating.—The heat used in warming buildings is of two kinds, radiant and convected. Radiant heat is that which comes in a direct line from a heated object in the same way as light; it can similarly be screened off, and, like light, decreases in power with the square of the distance, so that such a source of radiant heat as a fire is of little use in warming a large space. In a small room the walls and objects in the room are warmed by the fire, and they in their turn warm the air in the room, and the pleasantness of a room warmed in this way lies in the fact that, while the walls and objects in the room are warm, the air is comparatively cool, pleasant to breathe, and does not become dry. In heating with hot-water pipes there is practically no radiant heat; the air is heated by convection. As the air in immediate connection with the pipes becomes warmed, it rises, giving place to colder air, which is warmed in its turn.

Steam pipes being much hotter, give off some heat by radiation, a stove of course much more, but these highly heated surfaces tend to make the air in the room dry to an unpleasant and unwholesome degree; the organic matter in the air becomes charred, giving rise to the unpleasant and characteristic smell of a stove-heated room.

The different methods in use for heating a building are:—

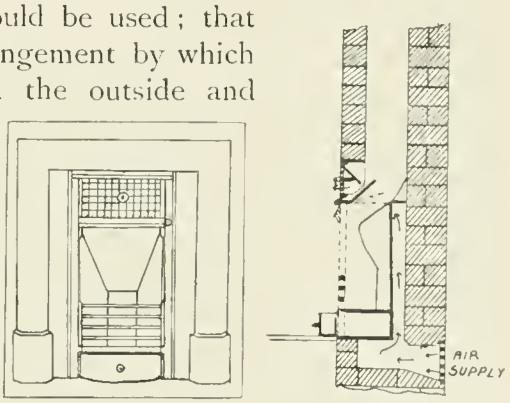
1. Ordinary grates.
2. Ventilating grates.
3. Stoves.
4. High and low pressure hot-water pipes.
5. Steam pipes.

The last two are either used "directly," *i.e.*, placed themselves in the room to be heated; or for the purpose of warming air, which is then propelled into the room. This is known as "indirect" heating.

The ordinary fireplace, a cheerful and attractive if uneconomical method, is still one of the most popular means for warming, and, as it necessarily ensures a considerable amount of ventilation as well as warmth, it makes, if a good form of grate be used, an excellent though wasteful means of heating small rooms. It is, however, almost

always necessary in a room used for a class-room to have some supplementary means of heating as well. If the grate be arranged, as is frequently the case, with a good draught, open underneath, and with the chimney at the back, the fire burns very fiercely, and, drawing a strong current of air, makes an unpleasant draught while very little heat is thrown out into the room, the chimney often absorbing over 90 per cent. of the heat produced. In order to warm the room a large fire has to be kept up, with the result that, since the pupils have to be placed all over the room, some are in a strong draught, some nearly roasted, the remainder merely cold. These objections can, however, be obviated to a large extent in grates of the type of the Teale Fireplace Company "Front Hob" or the "Nautilus," which, while restricting the draught, have large surfaces which heat the air by convection, and so warm the room without the heat being very fierce near the fireplace.

Ventilating Grates.—For school purposes, where there is no special apparatus to provide for the introduction of warmed air, some form of "ventilating" grate should be used; that is to say, a grate having an arrangement by which air is brought by a duct from the outside and passed over the hot back of the grate, and so admitted warm through a grating over the fireplace into the room. See Figs. 419, 420, which show a section and view of a Boyd's "Hygiastic" grate



419. 420.

Boyd's Hygiastic Ventilating Grate.

There are a number of excellent patterns on the market, but great care is necessary to see that the grate is carefully and properly fixed. In many cases where such grates have proved unsuccessful, the fault can be traced to ignorant or careless setting. The grate should be of some simple form so as to allow of taking to pieces easily for the periodic cleaning, which should under no circumstances be omitted. The great advantage of these grates is that by their use it is possible to bring a supply of fresh warmed air into a room at a very small cost; these grates have also great warming power for their size, since advantage is taken of the heat at the back of the fireplace, which under ordinary circumstances is entirely wasted.

Stoves.—It is not too much to say that of all forms of heating for school purposes the stove is absolutely the worst. It provides little ventilation; it heats the same air over and over again, charring and burning all the organic impurities; it reduces the air to a most unwholesome degree of dryness; and lastly, it is almost impossible to make a stove gas-tight; during the process of combustion very poisonous gases are formed, and these escape into the room through the cracks, the metal itself becoming to some degree pervious when sufficiently heated. It has one merit, that it is extraordinarily economical, and will heat a room in a very short time with very little expenditure of fuel, over 90 per cent. of the heat generated being made use of.

Stoves are sometimes used for warming fresh air that is then led into the room requiring to be heated. In this case the stove should stand in a chamber communicating with the external air and the building. The stove should be very large, so that it can give off sufficient heat without any danger of the surfaces becoming overheated, and suitable outlets from the room to be warmed must be arranged, or a due amount of air cannot gain admittance.

Hot-water Pipes.—Heating by the use of hot-water pipes, used either alone or to supplement that of open fires, is a means very commonly adopted. Although when used alone there is a loss of the cheerful appearance of the open fireplace, and also of a certain amount of ventilation, they possess many advantages. There is less labour in service; they provide a more equal distribution of heat, and they obviate the disturbance caused by making up open fires. While the initial cost of their installation is of course greater, the annual cost of their upkeep is as a rule less than that of open fires. A further advantage lies in their easy adaptability to any scheme of ventilation. Two forms are found—the low-pressure system, in which the pipes are large, 3 to 4 in. in diameter, and the temperature of which does not usually exceed 150° Fahr.; the high-pressure system, in which small pipes are used, formed to stand a considerable strain. As in this case the temperature of the pipes rises to a much higher point, often above that of boiling water, less area of piping is required. Another form known as the "limited" or "medium" high pressure, in which the pipes also are small, has been found of great use for school purposes. A system which allows the use of small pipes has certain advantages—the amount of liquid used is small, enabling heat to be produced in less time than with larger pipes; these small pipes are less unsightly, take up less room, and can

be taken into positions, such as under glass toplights, &c., where those of large bore could not conveniently be placed.

The use of steam for heating was until recent years generally confined to large workshops and similar places where the waste steam from the engine was made use of. It is, however, coming now into use for schools and other buildings, owing to the improvements made in the apparatus by American inventors. It has many advantages, being capable of quickly heating a room, and of being put in almost any position. It is apt, however, to overheat a building, and the pipes often become hot enough to cause an unpleasant smell by burning the organic impurities in the air. It requires a skilled engineer in charge of it; but it is usually found where there is already an engine for working machinery in the building, such as fans for ventilation, electric light, &c.

With regard to all these methods of heating, where steam or water pipes, or radiators are placed in the room to be heated, the result will be very bad unless proper means are provided for the admission of fresh air, as the same air is heated again and again. "This system of heating a schoolroom by steam pipes placed in the room is almost sure to involve a defective air supply, yet it is one that is peculiarly attractive to those who are not qualified to judge of the relative merits of the various methods of heating, since it is comparatively cheap and does give the requisite amount of warmth." *

The exactly opposite method is that known as the "indirect" method. In this case the incoming fresh air is heated sufficiently to warm the room. This method of warming is generally found in connection with the Plenum system, it being necessary to discharge air heated to this degree under pressure into the room.

But the introduction of air warmed sufficiently to render any other heating unnecessary has been strongly condemned on hygienic grounds. In all cases where warmed air is introduced into rooms, it cannot be too strongly urged that this should not be relied upon for the purpose of heating. Not only is air raised to this temperature enervating and unpleasant to breathe, but while the air in the room is warm the furniture and walls remain cold. As the late Sir Douglas Galton remarks in a paper read at an International Congress of Hygiene at Buda-Pesth—"The method of warming rooms by means of heated air necessarily leaves the walls colder than the air of the room, and the heat of the body is radiated to the colder walls. Hence,

* Ventilation and Heating, Dr Billings, p. 417. 1898.

if the walls are to be warmed by the air admitted to the room, the temperature of the warmed air must be raised beyond what is either comfortable or healthy for breathing, and thus, if you obtain your heat by warmed air alone admitted direct to the room, discomfort in one form or the other can with difficulty be avoided."

The extremely unpleasant and disagreeable effect of sitting close to a grating from which hot air is being discharged must be within the experience of most people.

On the whole I think there can be no doubt that the most satisfactory method is that known as the "direct indirect" system, in which fresh air is discharged at a temperature just sufficiently high to prevent the feeling of cold or draught, while the actual heating is provided for by some form of radiant heat, such as open fireplaces supplemented if necessary by hot-water pipes, or by pipes and radiators alone.

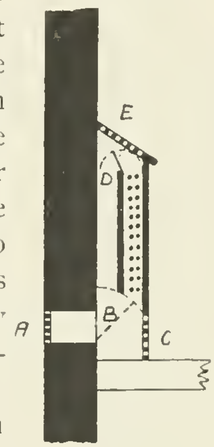
Care should be taken in the arrangement of the pipes. The practice of arranging hot-water pipes in channels below the floor with open gratings over should be unhesitatingly condemned. It is not only unnecessary but dangerous, owing to the difficulty of keeping them clean; there is in addition great loss of heating power. Hot-water coils, for the same reasons, should on no account have ornamental coverings. Radiators are now made in so many forms that they can usually be found to suit any position and any person's taste.

In regard to both the boiler and the area of heating surface it is most important that the allowance should be liberal. A large boiler will not only do its work more economically but last longer, and require stoking and looking to at longer intervals, and in a sudden snap of unusually cold weather can supply an extra amount of heating power. When, as too often happens, the boiler is cut down to the lowest size that can possibly be expected to do the work, it is found necessary during the winter months to strain its capacity to the utmost, thus involving constant attention and great waste of fuel; while in case of an unusual degree of cold it is incapable of keeping the building warm.

The heating engineer will of course determine the amount of piping required to heat the building to the required temperature, making of course the necessary allowances for loss of heat through walls, &c. There are, however, one or two considerations which are sometimes apt to be overlooked. For instance, the additional heating required according to the aspect of the school, whether the building is allowed to cool down during the night, and whether certain rooms are only required for use at intervals. The following figures are taken from a lecture before the

Franklin Institute by Mr R. Wolff* on the heating of large buildings. The heating power should be increased 10 per cent. for a northerly exposure; 10 per cent. when the building is heated in the daytime only. If the building is in a particularly exposed position this should be increased to 30 per cent. If the building is used intermittently with intervals of days or weeks of non-heating, the heating power requires raising 50 per cent.

Easy and complete control of the heating power is essential to convenience and comfort. The heating in each room should be separately under the management of the occupants, so that the idiosyncrasies of different masters can be satisfied. Especially in buildings heated by steam the rooms are often intolerably hot. There are many ways in which this can be managed. The radiators or pipes in the rooms may be arranged in sections so that more or less may be used. There should be some mean between having the heat full on or quite off. In Fig. 423 it will be seen that the radiator for warming the incoming air is arranged in sections. In rooms where the air is admitted into the room over a coil of hot-water pipes fixed either in or against the wall the inlet can be arranged with a valve or damper, so that more or less air can be allowed to pass over the pipes. This can be done in various ways. In Fig. 421 is shown a method suggested by the late Professor Jacob,† of which he gives the following description:—



421.

"The coil is enclosed in a box with a diaphragm running vertically throughout. By rotating the valve D at the upper part the stream of air is allowed to pass through the outer channel unheated, or over the coil so as to become warm, or by placing the valve in an intermediate position the air may be admitted of any required temperature. By closing the inlet valve B at the base the coil may be used entirely for heating purposes, the air circulating through the front opening C, ventilation being set up the moment the valve is opened." This should be a useful form of heating apparatus, as the coils can be used to heat the room until it is occupied, when, by opening the inlet, ventilation is at once set up.

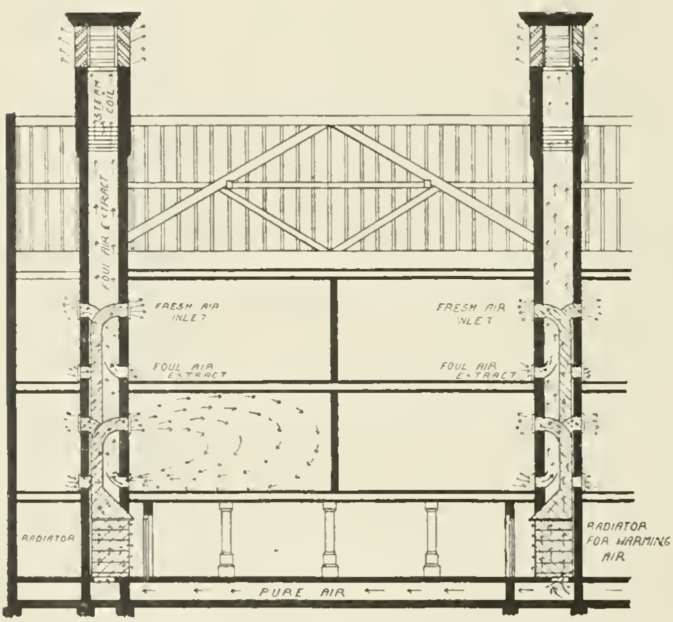
The Plenum System.—This method of combined heating and ventilating under pressure, that has come into great prominence in

* Quoted by Carpenter, The Ventilation and Heating of Buildings.

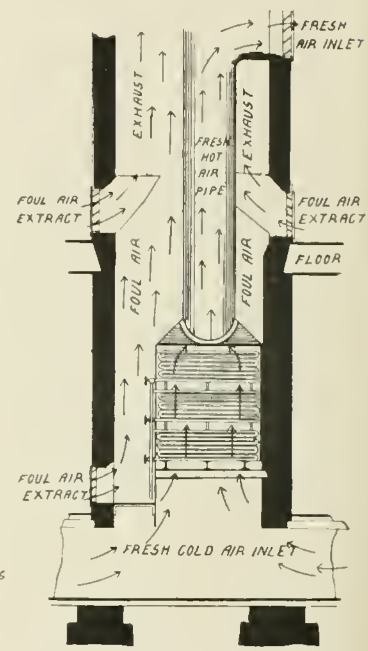
† Ventilation and Warming, p. 46.

recent years, has been already described from a theoretical standpoint. It is proposed to give here a short description of the method of its practical arrangement and working.

Fig. 422 shows a part of a school building heated and ventilated on the "Plenum" or downward system. The air is driven along the passages at the bottom, and then passes over coils of hot pipes, of which a greater or less number can be used by means of governing cocks (see Fig. 423). Each class-room has a separate flue to it. The fresh-air pipes, which are shaded in the figure, discharge near the ceiling. The foul air is taken off at the floor level into the upcast shaft,



422. Section of a Building Heated and Ventilated on the Plenum System.
The fresh-air pipes are shaded



423. Part of Fig. 422 Enlarged, showing Division of Coils, in order to give Control of the Heating Surface.

its movement being accelerated by a coil of steam pipes placed near the top of the flue. The air is intended to move on the lines of the arrows shown in one room.

The Conway Road Board School, Birmingham (illustrated on page 358) is heated and ventilated on this "Plenum" system. The position of the inlets and outlets are shown upon the plan, and a short account of the installation and its working may be of interest.

In this building the fresh warmed air is introduced into the main

halls at about 3 ft. 6 in. from the floor, and in the class-rooms at a height of 8 ft. The extract flues below and in the same wall are carried to the main shaft in the centre of the building. The air is drawn into the building through a jute screen with water running down it by a 4 H.P. gas engine. There is an ingenious contrivance for the blades of the propeller, the angle of which can be altered by means of a nut, and so alter the volume of air drawn in, but it must be doubtful whether an ordinary school caretaker would be competent to do this.

The air after being drawn in by the fan flows into two large parallel main ducts about 6 by 4 ft. running the length of the building, one on each side of the central hall. The air is brought in in the middle of the building, the main ducts running each way away from it at right angles to the direction of the entering air. From these mains the flues to each class-room are taken off, the opening of the flue being at the highest part of the duct, and at the mouth of each flue is fixed the heating apparatus. The entrance to the flues is made with a double mouth with a flap, so that by opening one or other the air can be heated or supplied cold as may be desired, by being made to pass over the small radiator, or allowed to enter without contact with it, the amount passing in being in both cases the same. This position of the heating apparatus gives an additional upward impetus to the air. Another method which is sometimes found in connection with the Plenum system, for governing the heat to be admitted to any single room without affecting the others, is that known as the double-duct system, in which there is a horizontal division formed in the main ducts, both parts being then connected to each class-room flue. The air in the upper duct only is heated, so that any class-room can draw its air from the heated or the cold duct, or can combine the two in any desired proportion.

To return to the description, the flues formed in the brick-work leading to the class-rooms are 4 ft. by 9 in. The fan which draws the air into the building has a diameter of 7 ft., and is arranged to run at 250 revolutions a minute in winter, and 300 in summer. It is calculated that this will change the air in the class-rooms six times an hour, which is hardly up to the requirements demanded by modern standards for this system of ventilation. There is no buzz or hum perceptible in the building from the fan. The cost of the installation was £1,800. As regards the success of this installation, I happened to visit the school on a warm day in the beginning of July, in the afternoon, and it did not seem to me that the state of the air was satisfactory; there was a quite perceptible variation in different

rooms. In one case the inlet had been nearly doubled in size, and in this room the air was undoubtedly the pleasantest. It is of course necessary for the successful working of the Plenum system that all windows should be kept closed, and there seemed something repugnant as well as unnecessary in keeping all the windows carefully shut, and going to considerable expense to draw air through screens, and then pump it along passages into rooms with every window closed on a fine summer afternoon, especially in the case of a building as this school, standing away from buildings, in a large open playground, well out of the town, when, by having all the windows open to ensure a free cross ventilation, the fresh air could have been allowed to sweep through the building, and so keep the air in the class-rooms as fresh as that outside. The conditions of the air in these class-rooms certainly compared very unfavourably with that in those of a school in Norwich, which I happened to have been visiting a few days previously, where, though the day was hot, the air in the building, with every window open, was delightfully fresh. It is quite likely that in winter the comparison would have been more in favour of the Birmingham School.

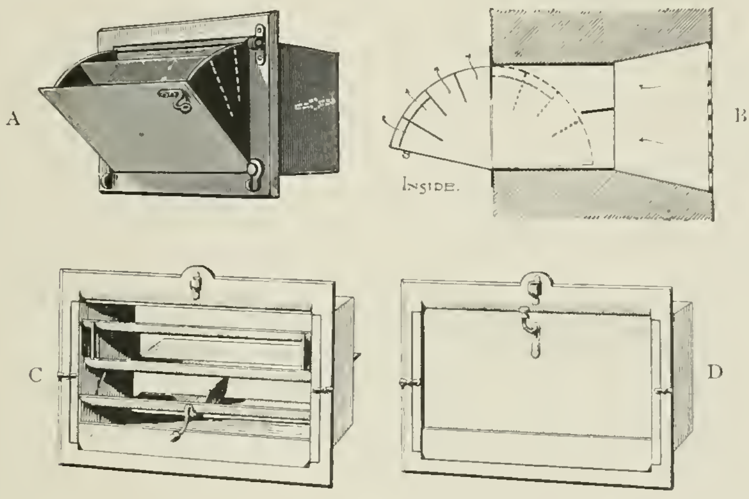
There is little doubt that increased experience will enable engineers to instal the pressure system of ventilation so that a satisfactory result will be secured in all the rooms of a school, but so far, whether owing to some inherent defect in the method or to faulty installation, it is difficult to avoid the conclusion that for school buildings the "downward" or pressure system has not been very successful. It is interesting to note that in the report issued by the Medical Officer to the late School Board for London in 1903 it is pointed out that the Plenum system does not appear to be suitable for London Schools, the reason given being that it was difficult to make it work satisfactorily in buildings of more than one storey.

In noisy streets where double windows are necessary, or in the middle of a town near factories, or where the air may be contaminated, it is of very great advantage to have a system which will obviate the necessity of opening the windows. But in the case of schools not placed in these unpleasant circumstances it would surely be as well to have the windows so arranged that when the cold weather is over they could be freely used. Ventilating engineers seem too apt to regard air, unless properly warmed, washed, and treated, as something dangerous.

In the ventilation and heating of large institutions where there are large rooms with considerable numbers of persons in them, it is necessary to have an elaborate installation of heating and ventilation. In these circumstances there is usually a skilled man to take control of the

furnace and apparatus, and, provided that the initial installation is well done, the results are highly satisfactory. Owing to the reasons given earlier in this chapter, it is suggested that the most satisfactory result will be gained by the adoption of a system which takes off the foul air at the top, and one in which the heating, although warm air is supplied, is to a large extent done by means of some system of direct heating. One thing is, I think, certain, and that is, as soon as the general lines of the system have been determined on, the whole arrangement and carrying out should be put in the hands of a really competent engineer, who should be given considerable power of discretion in order to adapt the system to the building in the best way.

Heating and Ventilation of Small Schools.—In the case of small Secondary and Private Schools it is not usually possible to



424.

A–D, Leather's Patent Uni-valve Louvre and Radial Ventilators.

afford the initial expense of a scheme of mechanical ventilation, nor the cost of maintenance involved in providing a skilled attendant, nor indeed is it really necessary. The rooms are usually of fair size, the classes small; and they are generally only used for forty minutes or an hour, when all the windows can be opened for a few minutes and be thoroughly aired. If there is a ventilating grate by which a certain amount of warmed fresh air is ensured, well-arranged inlet ventilators, such, for example, as those shown in Figs. 424, A to D, arranged to prevent the incoming air causing any unpleasant sensation of draught,

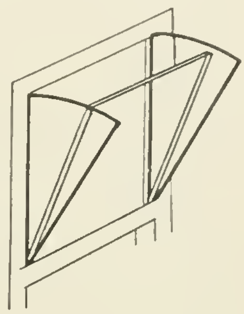
two extract flues of a fairly large area high up, and if possible connected to a chimney or some form of shaft with an upward draught; in addition the upper parts of the windows made to open on the hopper principle with side cheeks; and if there is no window on the opposite side, a proper ventilator over the door for the purpose of making a through current of air: it will then be found that quite sufficiently good ventilation can be obtained, provided that the means supplied are intelligently used, and that the Principal of the school will occasionally take the trouble to see that they are being so used, and insist on the rooms being thoroughly aired as soon as vacated. It is usually found better to place the hopper inlet ventilators in the lower panes of the window, as less down-draught will be caused; the upper parts should be also made to open.

Ventilation by Windows Only.—As it often happens that a school has to be carried on either temporarily or permanently in a building where no provision at all or quite inadequate provision for ventilation is provided, the best method of utilising the windows becomes of considerable importance. This is at best only a makeshift, and in cold weather is sure to lead to a certain amount of discomfort, though it is wonderful what a difference there is in the extent to which this discomfort will be tolerated. In the same school on the same day you will find one class-room with nearly all the windows open, while another has every one shut. A master or mistress who is a believer in open windows and fresh air will keep the windows open nearly all the year round, the children becoming apparently used very quickly to the feeling of draught. But windows cannot under any circumstances be considered good ventilators. In spring and summer, when the air is mild, it is pleasant enough to have all the windows open; but in windy and cold weather the case is very different, or when the air is full of smoke and fog.

In the case of wind, when there are two walls to the room with windows in them, it is of course best to open the windows, if circumstances will admit, to leeward. The slight tendency to vacuum caused by the aspirating power of the wind will draw the air out, and its place will be filled by air working its way in through cracks and crevices on the windward side.

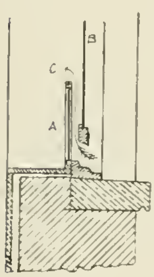
As a matter of fact, however, it is more usual to find all the windows on one side of the room. The only thing that can then be done is to open two or three windows slightly at the top. The wind will then come in, and to a certain extent ventilate the room. Some

of the openings will serve as inlets and some as outlets, but which will serve which part will depend upon the freaks and currents caused by the wind. There are various devices for checking the draught caused by the force of the wind. Windows can be fitted with hopper openings at the top (see Fig. 425), which have an excellent effect in turning up the current of air, but it should be remembered that the omission of the side cheeks will allow a large amount of cold air to flow down at the corners, and cause an unpleasant draught. Where the windows are not so arranged, a piece of board fastened obliquely to the top sash will do a good deal towards checking the draught. This of course interferes to some extent with the light. Fig. 426 shows the arrangement suggested originally by Hincke Bird for obtaining an upward current by means of raising one sash.



425.
HOPPER INLET FOR AIR.

The question whether the windows should be opened at the top or the bottom will be governed by the intention as to whether the opened window is intended to act as an inlet or outlet, a matter which requires a careful and intelligent observation of the conditions on the part of the teacher in control of the room. When there is little or no wind, the windows should all be opened both at the top and the bottom, the amount of course depending on the temperature. In cold weather the air will of course enter at a much greater pace. The top will then act, according to the season, as an outlet in winter and an inlet in hot weather. In still weather, when the temperature indoors approximates very closely to that outside, the only means of ventilation available is that of diffusion, and all that can be done is to open the windows top and bottom as widely as possible. It is when a strong wind is blowing that the greatest difficulty is found; still, by a careful arrangement, it is possible to keep a fairly constant current.

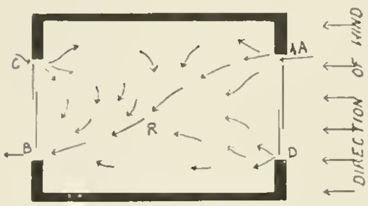


426.

In Fig. 427* is shown an arrangement of windows by which more or less satisfactory results may be obtained. This presupposes windows on two sides of the room, which makes the matter much easier. The size of the different openings should be carefully noted. By having a large opening at A and B there will be a strong current set up from A to B, as shown by the arrows. This tends to create a vacuum by

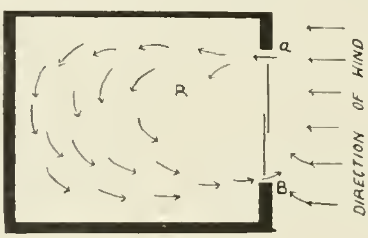
* The Ventilation of School Buildings. Morrison. 1901.

drawing the air from the other corners of the room. By then slightly opening the windows at C and D sufficient air will be drawn in to replace the air drawn out, and so the whole of the room will receive a fair ventilation, although the main bulk of the incoming air enters at the top, and is so warmed a little before descending. It would hardly be possible to keep to this arrangement in very cold weather.

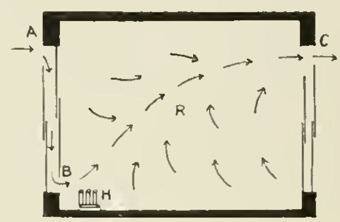


427.

Where the windows are on one side of the room only and there is a wind blowing in the direction of the arrows (Fig. 428), if the window is opened widely at the top, and only to a small degree at the bottom, a current will be set up in the direction shown; but unless the wind is of considerable power the current is apt to go in the opposite direction, causing unpleasant draughts, and the amount of ventilation that can be



428.



428A.

obtained will depend chiefly upon the fortitude of the children. Where there are double windows it is possible to arrange a more satisfactory system, as in Fig. 428A. In this case the air has time to become to some extent warmed before entering the room. Windows can also be utilised so as to provide for ventilation by so planning the class-rooms that every room has windows on each side; these are provided with hopper inlets at the top and bottom, and used to maintain a through current. Such an arrangement involves some sacrifice of convenience with regard to the plan of the school.

Chapter XXVI.

SANITATION.

General Considerations—Baths—Number required, and Arrangement of—Lavatories—Number of Basins required—Foot-baths—Swimming and Shower Baths for Elementary Schools—School Baths in America—Account with Illustrations of the Baths in the German Elementary Schools—A Bath in an English Poor Law School—Constant Stream Lavatories—Sanitary Conveniences—Number, Position, &c.—Warming and Ventilation of—Details—Trough-closets—Earth-closets—Latrines—Urinals, Details—Description, and Examples.

There is no part of the school building for which careful and intelligent supervision is more necessary than the sanitary arrangements. Unless the Principal is prepared occasionally to look himself or herself into such matters, it is pretty nearly certain that an unsatisfactory state of things will soon begin to prevail. In order that inspection may be easy and thorough, it is essential that every part should be so thoroughly lighted that there are no dark corners anywhere where any dirt or rubbish can lurk undetected. Deodorisers or disinfectants should not be allowed, since they take away one certain and easy means by which anything wrong can be discovered. Well-arranged and sanitary closets, properly and regularly cleaned, should not give rise to any unpleasant conditions.

BATHS, LAVATORIES, &c.

Baths are not as a rule found in Day Schools of any kind, or at any rate not provided with any idea of regular use by the school. In Boarding Schools the number that have to be provided depends of course upon what other facilities there are for bathing in the way of swimming-baths, and how often it is considered necessary that each inmate should have a bath.

If provision is to be made for a daily bath, it is necessary to supply at least one to every five boarders. In schools where swimming-baths are provided, and a bath once a week is required, about one bath for every fifteen to twenty will be probably sufficient.

Baths are made of a large number of different materials--zinc, copper, enamelled fireclay, slate, marble, wood lined with lead, and cast iron ; the last named being by far the commonest, and having many advantages, being cheap, durable, and cleanly. Fireclay and porcelain baths have the disadvantage of being very heavy and slow to take the heat of the water, giving an unpleasant chill to the persons using them.

For school use it is usual to arrange the baths in a row, either with or without partitions. They should not be cased in, and stand free from the wall, to allow of easy cleaning, the best form being undoubtedly some one of the many varieties of the so-called Roman baths, of cast iron with a vitreous enamelled surface. It is as well in a school bath-room, where there are several baths, to make the floor and walls of the room of such material that no damage may be done by the splashing that is sure to take place. The floor of the bath-room may be asphalted, the waste of the baths emptying directly into an open channel down one side of the room which discharges through an opening in the wall into a rain-water head, so that there is no arrangement of pipes at all, and the whole can be easily washed ; there is, too, no risk of stoppage should anything be thrown into the baths.

The taps, as a rule, are so arranged as to be turned on by an attendant with a key, or the hot-water tap alone may be so arranged.

In connection with the question of the provision of baths for Secondary Boarding Schools, it might well be considered whether it would not be more economical both in time and money to adopt some modification of the spray-bath as used in German and American Elementary Schools, such as are described below. That shown in Fig. 440, page 468, would answer the purpose well. An arrangement of this kind would be not only less expensive in the initial cost and take up less room, but would enable a very large number to take a bath in a very short time, as there is no time wasted in emptying or filling the baths. Any possibility of the same water being used twice over is also prevented.

Lavatories.—In Secondary Day Schools, and for day use in Boarding Schools,* the number of basins supplied may be reckoned at five for a hundred boys, while in Girls' Schools rather a larger number are generally provided, say one to every fifteen girls. These numbers

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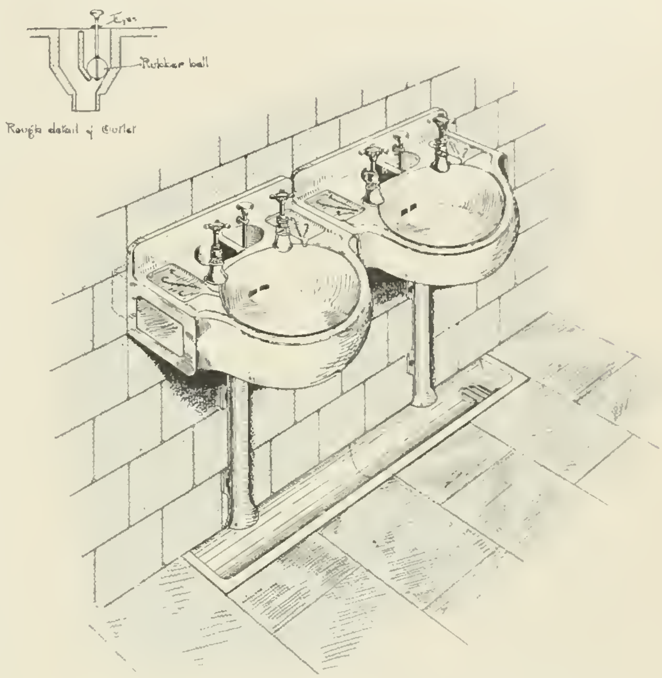
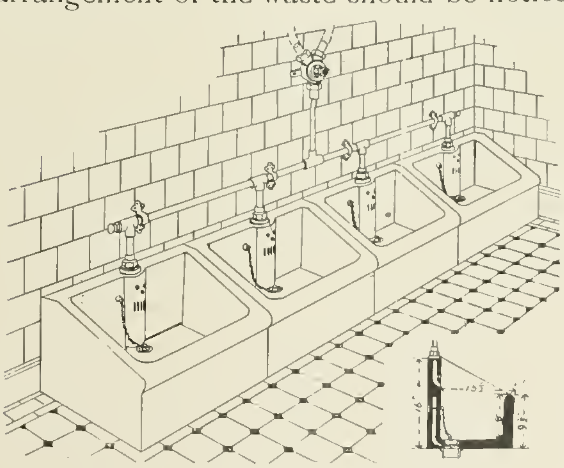
* For arrangements of basins in dormitories in Boarding Schools, see page 225.

will have to be largely increased in case many pupils stay to dinner in the middle of the day, as there will then be a large number requiring to wash at the same time. For Elementary Schools the numbers are usually reckoned at four per hundred for the Boys' Department, and five for the Girls'. Enamelled fireclay being strong, durable, and easily cleaned, makes an excellent material. The ranges of basins with slate tops do not have a pleasant appearance. A form of basin specially designed for school work by Messrs Adams is shown in Fig. 429. These are built into the wall, and discharge into an open gulley in the floor, so allowing of easy and thorough cleansing. The arrangement of the waste should be noticed. The lavatories, arranged to prevent the same water being used twice over, are described below. These are usually arranged so that the water is turned on to the whole range at once, and are not usually found in Secondary Schools.



429. Lavatory Basins by Messrs Adams.



430. A Range of Foot-Baths.

Foot-baths are sometimes provided, and are a useful adjunct to a changing room or to a swimming-bath, so that they can be used by boys coming to the baths straight from playing football, the best material for the purpose being glazed fireclay. Enamelled iron is also

used. The usual plan is to provide a range of these foot-baths (see Fig. 430), which shows an arrangement of Messrs Shanks. These baths are made in one piece of glazed fireclay. The water is turned on simultaneously by means of a key, and so arranged that it is impossible to turn on the hot water without first turning on the cold, thus preventing any danger of scalding. The dimensions are shown in the section, each bath occupying about 19 in. in length. In ranges of this kind it is unnecessary to trap each single bath, provided that the waste is properly trapped beyond the last fitting.

Swimming and Shower Baths for Elementary Schools.—While we have not got yet in this country to the point of systematically washing all the children in the Elementary Schools once a week, as is becoming more and more the custom in Germany and America, where in the more recently built schools very elaborate arrangements are made for this purpose, yet some of the London Board Schools have swimming-baths specially built in connection with the school, and, in many, arrangements are made with some neighbouring baths, by which the school may have the use of the bath at certain times at special rates, though this seems to be done more in order to teach swimming than for the purpose of health and cleansing, attendance at swimming lessons being counted as attendance at school. Two Board Schools in Edinburgh (see Fig. 340 and Fig. 344) have a swimming-bath placed in the basement of the school, as have also some of the Glasgow Schools. In the latest school built in Edinburgh the swimming-bath has been omitted, owing apparently to objections on the part of the ratepayers. The bathing in the German Schools is effected by an arrangement of shower-baths, and without any idea of instruction in swimming. It is done not only with a view to personal cleanliness and the consequent advantage to health, but it is considered also to have an excellent moral and educational value from the increased feeling of self-respect due to bodily neatness and cleanliness.

The kind of bath that is suited for an Elementary School is thus described by Mr Bailey.* The swimming-pool will be 50 by 20 ft., 2 ft. 9 in. deep at one end going down to 5 ft. 6 in. at the other, lined with white glazed bricks, and having steps, diving-board, and handrail. The dressing-boxes should be 2 ft. 6 in. wide and 3 ft. 6 in. deep, merely formed as partitions with half doors along two sides, with a

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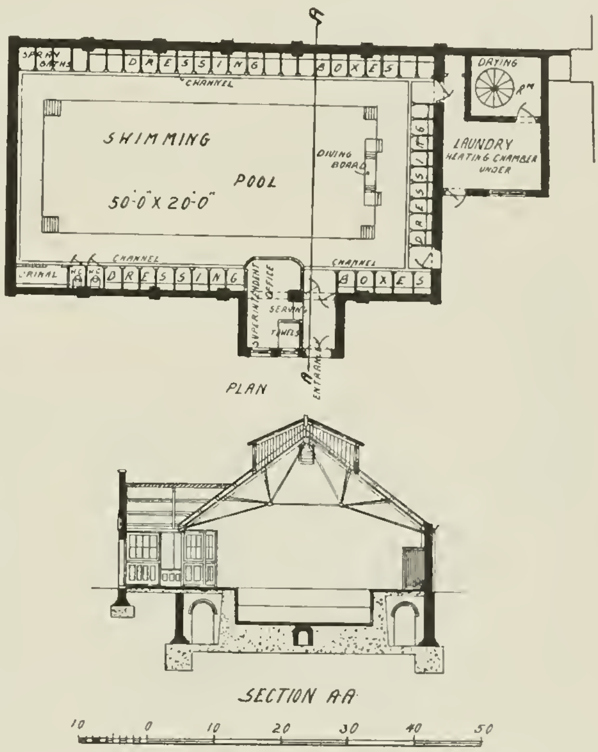
* Paper read to the Royal Institution of British Architects, "The Planning of Elementary Schools," July 1899.

small number of larger boxes for the use of the teachers. There will have to be supplied also urinals and W.C.'s; also four spray-baths, which are considered essential for cleansing purposes before entering the swimming-pool; also, in connection with the heating apparatus, a washing and drying room for towels and bathing dresses (see Figs. 431, 432).

While it is at least doubtful whether anything approaching the system of baths recently adopted in Germany and America is ever likely to find a place in this country, it has been thought worth while to give a short account of them, as the arrangements would do admirably for a Poor Law School or similar institutions where a number of children are boarded and require baths in large numbers, the use of baths of the ordinary type being a lengthy and tedious process. This plan of providing baths in the Elementary Day Schools is a comparatively recent innovation in America, and the following remarks of a recent writer on School Hygiene in reference to it may be of interest:—



431, 432. Swimming-Bath for an Elementary School.

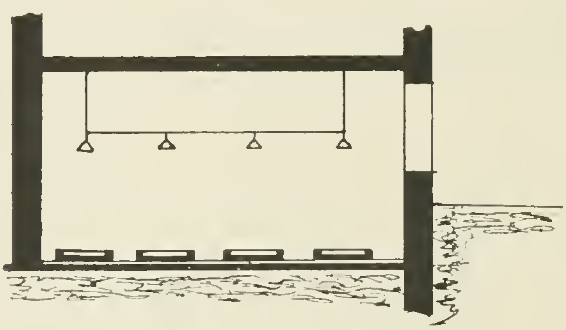
T. J. Bailey, Architect.

"The school baths established and projected in this country are for the purpose of educating certain portions of the community in bodily cleanliness. That there is such need of such education in certain parts of our cities cannot be denied. In crowded quarters, under the pressure of hard conditions and surroundings, personal cleanliness gradually becomes neglected, habits of uncleanliness are formed, and moral deterioration surely follows. The testimony of those who have instituted school baths is strong with reference to the physical and moral results arising therefrom. A child, it is found, has much more respect for himself when clean, and is much more responsive to law and order, and a positive moral influence is exerted upon the parents and homes of the children. For one thing, it shows

itself in cleaner clothing for the child. It counteracts the unwholesome personal habits engendered in such homes, for the habit of bathing and cleanliness formed by the child from regular weekly baths from the age of six to fourteen will continue with him through life." *

There are plenty of schools in the poorer districts of London where these remarks would apply with equal force. It should be remarked that the bathing above referred to is not compulsory, but as a matter of fact the opportunity is taken advantage of by 99 per cent. of the pupils.

The plan usually adopted in German Schools is as follows :—There are two rooms, one of which serves as the dressing and undressing room ; in the other are arranged the shower-baths, under each spray being a sort of large basin, serving the purpose of foot-washing as a preliminary to the shower-bath (see Fig. 433). There should be space in the dressing-room for twice or even three times the number that can use the shower-baths, in order to save time. There are many different ways of arranging the shower-baths. In some cases the basins or tubs under the shower-bath are as large as 5 ft., in which case there would be three pupils allowed to each. Sometimes a long trough is used (see Fig. 434, below), or separate little cells with a shower-bath in each. The children bathe twice a week in some schools, once a week in others, but in no case are the baths compulsory.

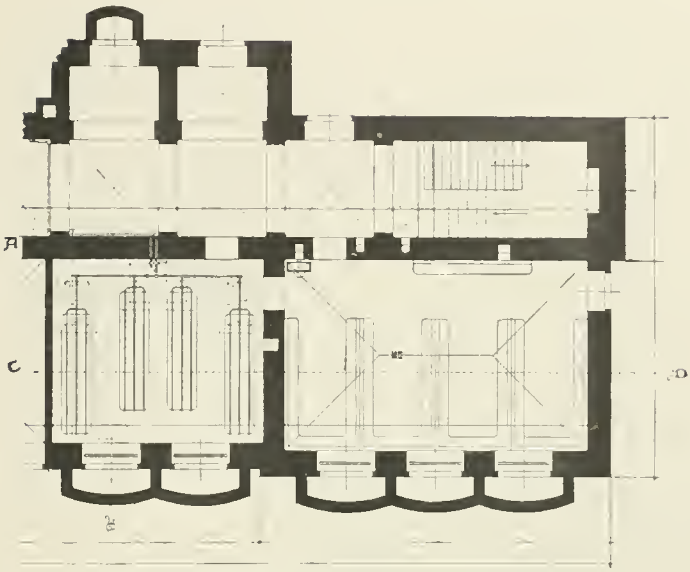


433. A Row of Shower-Baths.

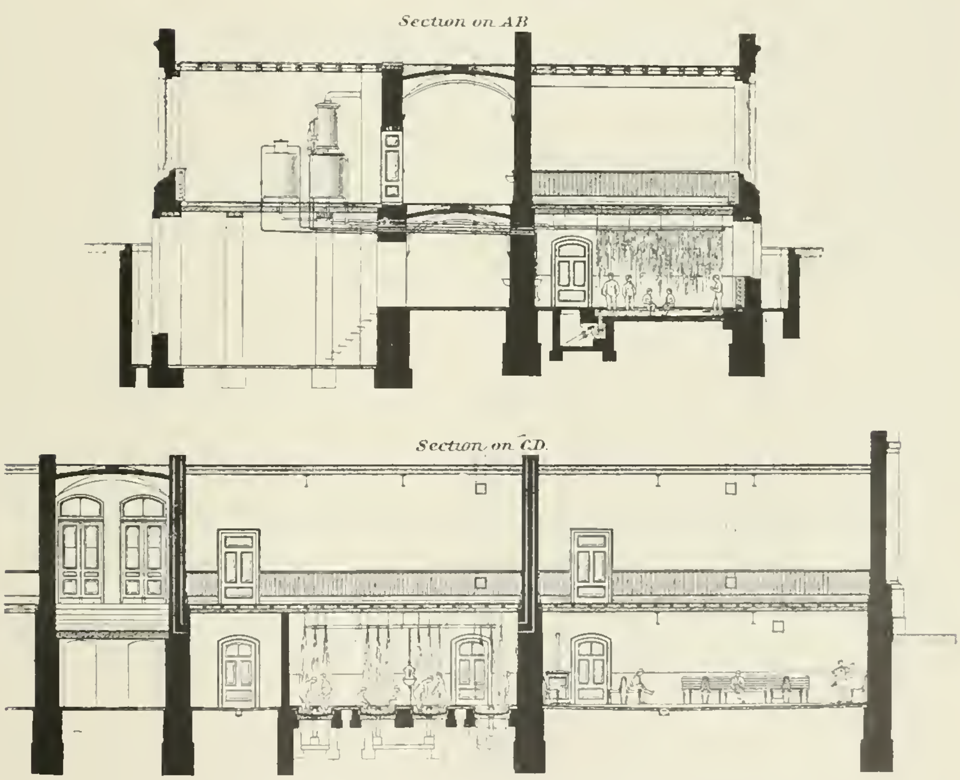
The plans and description of the baths for a school recently erected at Frankfort-on-Main are taken from a descriptive pamphlet of the schools of that town by Herr Adolph Koch, State Building Inspector of Frankfort.

The bathing arrangements usually found in the Frankfort Schools were capable of accommodating from thirty to thirty-six children. But the great advantage of being able to deal with a whole class at a time induced the authorities in the newer schools to make the accommodation

* School Hygiene, E. Shaw, p. 133.



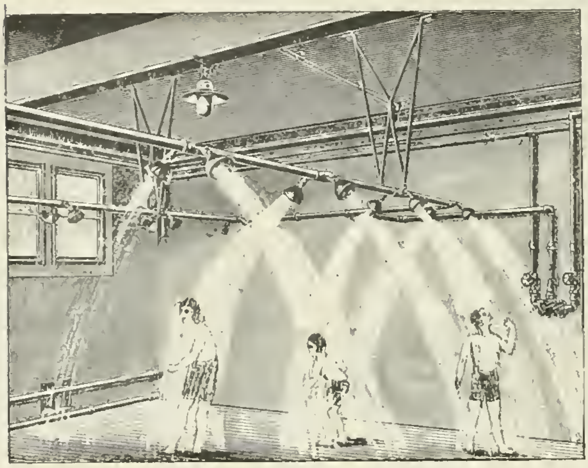
434. THE BATHS IN A SCHOOL AT FRANKFORT.



435, 436. SECTIONS OF THE SCHOOL BATHS AT FRANKFORT.

capable of dealing with sixty at once, the arrangement being as follows (see Figs. 434-436):—

There are in the basement dressing-rooms measuring 33 ft. 3 in. by 21 ft. with benches round the wall and in the middle of the room for sixty children. This room is heated by the heating apparatus of the school building in winter. When requiring heating at periods during which the main apparatus is not heating, this is done by means of a gas stove. The cement floor is covered with linoleum. The bath-room next door, a square room of about 23 ft., has sunk in the floor to a depth of about 10 in. four troughs about 13 ft. long and 3 ft. 3 in. wide, made in cement; over each of these near the ceiling are arranged three pipes running in the same direction as the troughs, the under sides of which are pierced with two rows of small holes, arranged so that the falling water shall all come within the edge of the trough. The water is heated by a gas water-heater, which will give the required temperature in a few minutes, being arranged above the level of the ceiling of the bath-room to have the necessary fall. The lower parts of the wall of this room are lined with white glazed tiles, the upper parts with waterproof paint. The baths are worked as follows:—The whole class, consisting as a rule of sixty children, after undressing in the first room, go all together into the bath-room, take up their positions in the troughs, and, sitting on the edge, wash their feet, three or four minutes being allowed for this; they then range themselves under the sprays, which are opened for two to three minutes, then the children return to the dressing-rooms. It is claimed that the whole process for a class of sixty, including dressing and undressing, can be got through in from ten to fifteen minutes, according to the age of the class. This period just corresponds with that of the recess between the two periods of work, so that a class can make use of the bath-room without any waste of time; it can then during the time of the next lesson be prepared for another batch. The cost of the whole arrangement as just described is reckoned at about 4,900 marks, or say £245. The cost of using is calculated to come to one penny per head.



437. Baths in a School at Zürich.

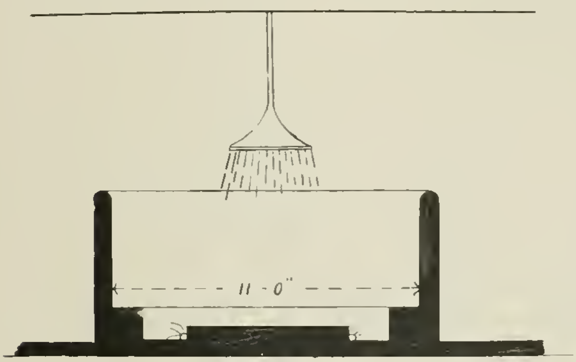
This is a rather more complete arrangement than is usually met with. Sometimes the dressing-rooms and shower-baths are in the same room. The water is always turned on by an attendant who regulates

the temperature. This is usually about 113° Fahr. to start with, being gradually cooled down to 86° Fahr.

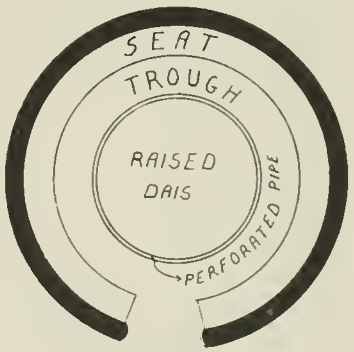
German authorities recommend that the water should not be allowed to descend vertically upon the head of the bathers. Fig. 437 shows the arrangement suggested to prevent this.

The following account of the system in America is drawn from Mr Shaw's book on School Hygiene :—

In Boston in the Paul Revere School baths have been in use since 1898. This is a school of 800 boys and girls, and 125 are bathed daily, the whole school having a bath weekly during the school year. There is a period of bathing allotted to each class as for a lesson. There are ten shower-baths and thirty dressing-closets. Each bath has a flexible rubber tube reaching to the floor with a spray at the end, and the occupant can direct the spray as he pleases and the amount of water. The temperature is regulated by the attendant to about



438. Section.



439. Plan.

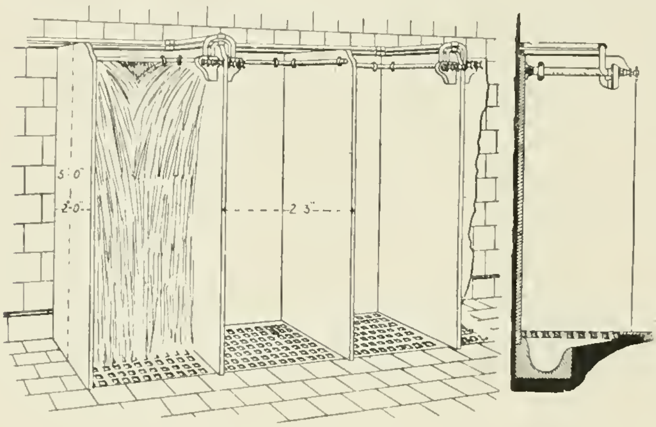
SKETCH DIAGRAM OF A FORM OF SPRAY-BATH.

90°. The bath-closets are made of marble with a rubber sliding screen, and measure 1 ft. 5 in. in height, 2 ft. 11 in. wide, and 3 ft. 8 in. deep. The dressing-closets are made of wood and are a little narrower, being only 2 ft. 3 in. wide. Soap and towels are furnished, and the average cost is about $3\frac{1}{2}$ cents. In a school just finished at New York there are baths arranged on a still more comfortable plan. There are fourteen baths, each of which combines with it a dressing-closet, the whole being a sort of double compartment with a sliding door let in made of rubber, so that the bather steps from the dressing-closet into the bath-closet. The measurements are 7 ft. in height, 6 ft. 4 in. in depth, the width being 3 ft. 2 in. The frames are made of iron, and the sides of wired glass reaching to within 6 in. of the floor.

A somewhat similar method on a smaller scale of dealing with a large number of boys is in use at the Poor Law Schools belonging to the Edmonton Union at Enfield. The Superintendent, Mr Livocke,

finding that much time and trouble was involved in washing a large number, some 200 boys, in the ordinary baths, devised the following scheme (see Figs. 438, 439) :—

There is a circular trough formed in the floor of white glazed bricks, round which runs a seat of similar material, the whole being enclosed with a circular wall about 4 ft. 6 in. high covered with cement, in which there is an opening for entrance. Over the raised centre portion, about 7 ft. in diameter, enclosed by the trough, is arranged a large rose spray fed by water from a special gas water-heater and controlled by the attendant. At the bottom of the trough is a copper tube pierced with small holes. The *modus operandi* is as follows :—The boys, ten at a time, when undressed, enter through the opening in the centre of the wall, each boy receiving as he enters a small dab of soft soap on the head; they then sit on the edge round the trough; the water comes into this trough through the perforated tube, and they proceed to wash their feet. Upon the completion of this they stand in a group in the centre, the water is turned on, and by means of the conveniently placed soap, a thorough cleansing is rapidly effected. This is only done in the Boys' Department.



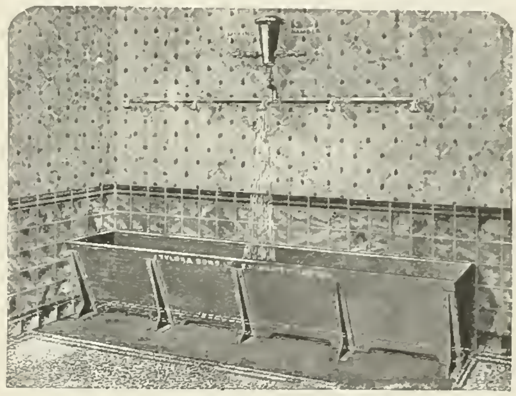
440. 441. Section.

A Spray-Bath by Messrs Shanks.

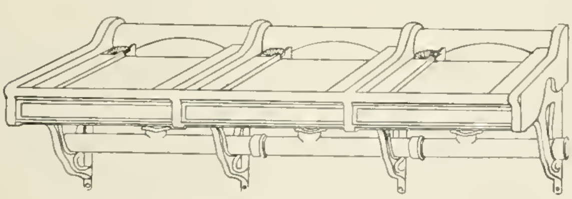
Figs. 440, 441 is a form of spray bath made by Messrs Shanks which would well serve the purpose of providing a rapid means of washing a large number or for use before entering a swimming-bath. A waterproof curtain could of course be hung in front if desired. This is the form of bath that it is suggested above might well be used for Secondary Boarding Schools, since it not only provides a great economy of time, saving the filling and emptying, but takes up relatively so little space.

In both Public Elementary Schools and Poor Law Schools and similar institutions careful precautions have to be taken to ensure that two children cannot use the same water for washing in, as many diseases, especially various forms of eye disease, are thought to be communicated in this way. There are a number of ways of making it impossible for one child to wash in water previously used, by the use of what are known as "constant stream" lavatories in which the water

is constantly changing. In its simplest form it consists merely of a pipe with small perforations discharging over an open grating, and so forming a kind of long shower-bath. One of the earliest forms was Doulton's trough lavatory, which consisted of a long trough about 12 in. wide, with sprays about 20 in. apart, the discharges being into an open floor channel, to which the floor should slope, as there is bound to be a good deal of splashing in such lavatories. Fig. 442 shows a form of lavatory made by Messrs Tylor adapted for this purpose, each child washing in a separate spray which is kept running during use. In Fig. 443 is shown a range of Shanks' "Instanter" lavatories. The water, entering at the back, flows across the basin and over the edge down the waste, a small hole being arranged to empty the basin when the water is turned off. The water is turned on into all the basins at once by one tap, it being usual to have one basin at the end with a separate supply cock, so that if only one child requires to wash it can do so without the necessity of turning on the water to the whole range. This form of lavatory has been fitted in a large number of schools, and seems very satisfactory; the only objection I have heard to it being that owing to the shallowness of the water children have some little difficulty at first in washing.



442. A Form of Lavatory to avoid the use of the same Water twice over. By Messrs Tylor.



443. A Range of "Instanter" Lavatory Basins. Messrs Shanks.

In the schools of the London School Board basins are provided of some simple pattern. The taps, when a separate water supply is provided to each basin, should be of some strong self-closing pattern. Screw taps are very liable to be left not fully turned off. Lock taps are useful when the water is turned on by an attendant for a range of basins.

WATER-CLOSETS AND URINALS.

Position.—The position of the sanitary conveniences in a school building requires considerable care. As far as the Elementary Schools are concerned, the question is practically settled by the regulations for school buildings issued by the Board of Education, it being laid down that "water-closets within the building are not desirable, and are only required for women teachers; all others should be at a short distance, and completely disconnected from the school building." While this precaution may be necessary, and considering the appliances still to be found in many schools is sometimes certainly so, there is a considerable hardship in this arrangement for very young children in cold weather. Provided that proper appliances are used, and sufficient care be taken to cut them off from the main building by an intercepting lobby, efficiently ventilated, there should be no risk in having them attached to the main building. In America it is common to find them placed in the basement, but this can only be done in schools where an efficient system of ventilation is in force. They are as a rule cut off from the rest of the building by a lobby with self-closing doors, and are ventilated by a separate ventilating apparatus, kept carefully apart from that for the rest of the building.

In Germany, while in the older schools they were often placed on the landings of the stairs, the unpleasant conditions arising from this has led to their being placed usually outside the building, but always connected by a covered way of some sort, the separate block of sanitary conveniences approached through the open air being seldom or never found.

In Secondary Schools for boys there is usually a sanitary block separated from the other buildings, though it is also common to find them attached to the main building. In Girls' Schools they are of course always in or attached to the main building. A common plan is to make the lavatory serve as an intercepting lobby to the cloak-room, as Fig. 101. This not only answers the purpose well, but is a convenient position for the lavatory, which may with advantage also be close to the cloak-rooms. It is often found a convenience to place all the sanitary arrangements, lavatories, &c., in a spur building cut off from the main block by a cross ventilated lobby, and so arranged that access is possible from each floor. Care is required, in placing closets for the mistresses, that while they are in convenient positions the access should be screened from general observation.

In Boarding Schools provision has to be made for a certain

number of closets for night use only. These are arranged usually in the proportion of say two to twenty-five beds near the dormitories, with access through a cross ventilated passage, and often combined with the baths, lavatory basins, &c.

The closets and the passages or lobby leading to them should be warmed, a temperature of about 55° being sufficient. The ventilation should of course be arranged with great care to prevent any chance of back draughts. Separate sanitary blocks ventilated only by the windows or louvre outlets in the roof must be so placed that they do not come under any of the class-room windows.

Number of Fittings required.—As regards the number of closets that are required, the regulations of the Board of Education give the following table for Day Schools :—

	For Girls.	For Boys.	For Infants.
Under 30 children - - -	2	1	2
,, 50 ,, - - -	3	2	3
,, 70 ,, - - -	4	2	3
,, 100 ,, - - -	5	3	4
,, 150 ,, - - -	6	3	5
,, 200 ,, - - -	8	4	6
,, 300 ,, - - -	12	5	8
There should be urinals in the proportion of 10 ft. per 100 boys.			

This table, from the Rules issued in September 1905, shows a slight increase in the number of fittings required for girls over two hundred. These figures are usually adopted for Day Schools of all kinds. For Boarding Schools* it is generally reckoned that there should be not less than fifteen per hundred in the case of girls, and ten per hundred for boys in addition to urinals.

Water-closets.—The pattern of closet best adapted for school work is that which is least liable to get out of order from ignorant or careless use ; for this reason the valve closet is probably better avoided, and some good pattern of wash-down closet selected. There are many patterns of this kind on the market, and it would not be possible to mention all the different kinds. Care should be taken to see that there is a large area of water and good depth of seal. A later development of this form is that known as siphonic wash-down closets, in which

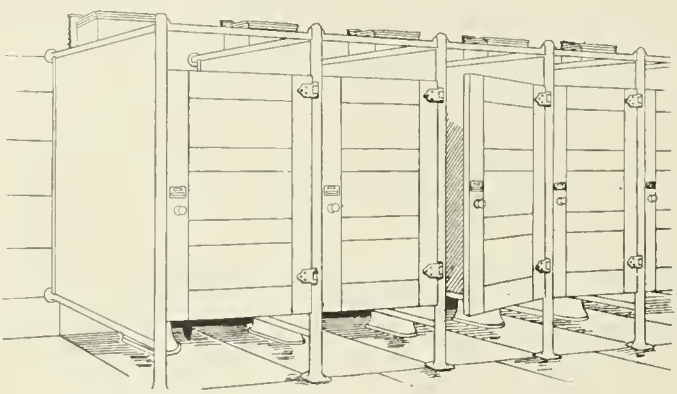
* For the arrangement of these, see page 229.

advantage is taken of the additional power to be gained from the siphonic action set up by a rapid flush of water. These closets have great self-cleansing powers.

The closets should of course be of the type known as "pedestal," not covered in with any wood-work, so as to allow of easy cleaning. Closets of the bracket and projecting type, and built into the wall, allow of the whole floor being thoroughly washed.

The water supply should be abundant and the supply pipes of large diameter, since it often happens that they are all in use at the same time. The walls should be covered with glazed tiles or some material easily washable, and upon which writing is impossible; the floor so arranged that the whole can be easily washed.

In Secondary Schools it is usual to find the closets separate, each with its own supply cistern, and this is no doubt the most satisfactory



444. A Range of Closets. Messrs Shanks.

arrangement. In order to allow of easy and sufficient washing and inspection, some arrangement of the kind shown in Fig. 444, in which neither the doors nor the partitions are carried down to the floor, will prove satisfactory. In Elementary Schools some arrangement of latrines or trough-closets are often found which are flushed all together, the discharge being started by hand, or perhaps more usually automatically. In its simplest form it consists simply of a long stoneware or iron trough running beneath a number of separate seats or compartments, with an automatic flushing tank fixed at one end, set to flush the tanks at intervals regulated by the tap on the supply pipe. The trough is inclined downwards towards the outlet, where is placed a siphon trap, there being a slightly raised piece or weir at the end to ensure a certain amount of water standing in the trough. To ensure proper flushing a very large amount of water is required, as much as

50 gallons being allowed for a range of 12 ft. These trough-closets are by no means satisfactory even with a large water supply, and should not find a place in a school building. In order to keep the advantage of automatically flushing a number of closets together, various arrangements of connected closets are made, but trapped from each other by the water standing in the pipe between. These are generally known as "latrines," in order to distinguish them from trough-closets. These latrines are usually emptied by a siphonic discharge, and certain disadvantages incident to this form are minimised by placing the discharge pipe in the centre of the range instead of at the end. The ranges are usually made with a distance of 2 ft. 3 in. to 2 ft. 6 in. from centre to centre of closet, but they can be made any distance that may be desirable up to 3 ft. 6 in. The sizes of pipes for this number of closets would be—Inside diameter of horizontal pipe, 4 in.; of trap, $5\frac{1}{2}$ in.; of feed pipe, 3 in.; while a tank measuring 36 by 30 by 18 in. is required. In order to obtain more complete isolation of each individual closet, latrines are made in which the pipe is behind the basins, each closet having an outlet at the back. As latrines of this description are usually placed in outbuildings, often unwarmed, they are very liable to damage by frost. It is therefore advisable to have them made of thick stoneware, and also to have some arrangement by which the basins and connecting pipes can be emptied, the trap at the end being of course left charged.

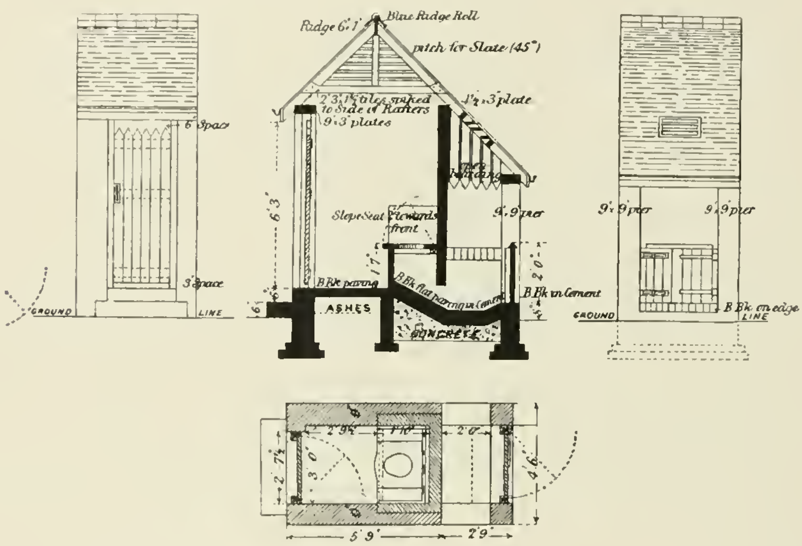
Wash-down closets of the ordinary type are often fitted in ranges, and so form latrines flushed by a single tank. The flush should in this case be two or three times the amount usually allowed for a single closet.

Earth-closets.—In the majority of schools situated in the country there is no general sewerage scheme available, and some other means for the disposal of the sewage must be adopted. The plan of simply arranging seats over a deep pit or cesspool is unfortunately still not uncommon in outlying country districts. The arrangement usually has an opening at the back for cleaning purposes, an operation which, under the most favourable circumstances, is not likely to be carried out more than once a month. A system of earth-closets properly arranged and carried out is a perfectly hygienic and sanitary arrangement. The most satisfactory form is that of the pail system. A galvanised iron pail is placed under the seat, and earth added every day, the pails when full being taken out and emptied. It is of course as essential in this system as in any other that it should be some one's business to see

that all the necessary work is properly attended to, and it should be the part of the Head Teacher to make sure that it is done.

The earth supplied should be of a loamy nature, perfectly dry and finely sifted. Sand is unsuitable. There should be supplied about 1 cwt. weekly for every six persons using the closet; this would allow for a daily use. The earth, if kept in a dry place, can be used again in about six weeks' time. Ashes and peat dust are also used, but are not so satisfactory as good earth.

Privies should only be used when unavoidable. They should be kept well away from the buildings, and thoroughly ventilated. The



445, 446.

best form of construction is probably that designed by the late Mr Sylvanus Trevail, and adopted as a standard method by the Board of Education. Figs. 445-448 show the arrangement. The important point in their construction is that the bottom of the pit must be at least 3 in. above the ground level. The following notes upon their construction may be useful :—

Privies constructed as above should be placed as far as possible from dwellings and wells, and not less than 20 ft. from the school.

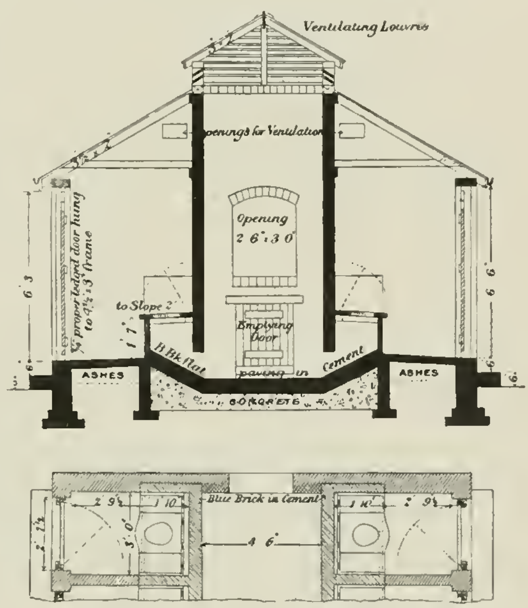
Excavate for foundations to a sound bottom, not less than 18 in. below surface of ground. Build privies with good sound hard bricks laid in mortar. The walls to be 9 in. and $4\frac{1}{2}$ in. in thickness, as shown, and leave out apertures for ventilation where shown. Put blue brick in cement damp course 3 in. thick

to all walls at ground level. Turn arches over pits on 2 in. by ½ in. wrought-iron bars. Pave floor of privy with blue brick flat paving or slate paving in mortar, on a good bed of ashes. Construct ashpit as shown, **the bottom of pit to be 3 in. above ground level.** Lay the bottom of pit and line the sides of same where shown with good seconds blue brick bedded and jointed in cement, and the bottom to be on a foundation of concrete 6 in. thick. Form slope to bottom of pit as shown, and render bottom and sides of pit in cement.

All copings to be blue brick on edge, bedded and jointed in cement.

The riser of privy seat to be 2 in. stone or slate, well secured to walls at each end, and bedded in cement.

Form steps with stone or blue brick in cement, fixed on a solid bottom.



447, 448.

DESIGNS FOR STANDARD EARTH-CLOSETS.

The roof to be constructed as shown with 4½ in. by 3 in. wall-plates, 6 in. by 1 in. fillets, 3½ in. by 2 in. rafters, and 6 in. by 1 in. ridge, and to have 3 in. by 1½ in. ties spiked to sides of rafters. Slate or tile the roof on 2 in. by ¾ in. battens, and finish with plain blue ridge roll, or crest tile. (If covered with tiles, the roof should be not less than 45° pitch, as shown on section.) Privy doors to have 4½ in. by 3 in. proper rebated door frames secured with iron dowels, and the doors to be ¾ in. proper ledged doors hung on strong wrought-iron hinges, and fitted with good latch, and bolt inside. The top of door to be cut 6 in. short as shown, and the bottom to be fixed 3 in. above floor of privy for inlet of air.

The door of ashpit to be ¾ in. proper ledged door, hung to 4½ in. by 3 in. rebated door frame, with strong wrought-iron hinges, and fitted with strong wrought-iron bolts.

Put a louvre ventilator at the highest part of privy as shown.

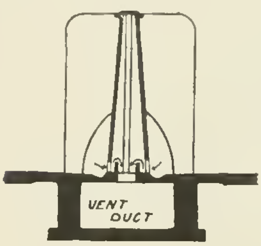
Privy to have a proper holed and dished seat 1¼ in. thick, hung to 3 in. by 3 in. oak rail, and to slope 2 in. towards front, and be made to lift up as shown.

Put ¾ in. boarding with open joints, as shown, on each side of ashpit. Paint all wood-work, except seats, three coats good oil colour.

N.B.—The privy may be 6 in. deeper than shown on plan with advantage (the minimum size being given here), and where stone is used the walls should not be less than 16 in. thick.

Urinals.—Urinals should be provided in the proportion of one to every fifteen boys. These require far more care and attention both in

construction and in looking after than they usually receive. It is no uncommon thing to find, in schools otherwise extremely well provided and well looked after, most unpleasant conditions prevailing here. Unless liberal flushing arrangements are provided, properly arranged and freely used, inconvenience is sure to arise. Nothing but impervious materials should be used, such as glazed fireclay, or polished and oiled slate, or marble. The form of urinal very commonly found in school playgrounds is that of stalls composed of slate slabs fixed from 18 in. to 2 ft. apart, and projecting 18 in., with a sparge pipe for flushing. The slabs are usually $1\frac{1}{2}$ in. thick. Effective cleansing is possible when the divisions are arranged so that they are not carried down to the floor. Holdfasts for supporting the slabs should be of copper, as iron is soon corroded. This form of urinal has the advantage of being inexpensive, and, if fixed in the playground and well looked after, may be prevented from being very offensive; but owing to the corners and angles it cannot be efficiently cleaned, an objection which applies to all forms of urinals made of slabs of whatever material. A further disadvantage of slate lies in the facilities it offers for writing and scribbling on. This objection can be overcome by periodically covering the slate with a mixture of coal-tar and naphtha, which has the further advantage of preventing absorption. The slate is also much improved by oiling. Fig. 449 shows an arrangement suggested by Mr Wheelwright,* as used in American Schools, in which the ventilation duct is carried through the middle. Satisfactory results are claimed for this arrangement.



449.

The great improvement in recent years in the production of enamelled fireclay has made it possible to produce urinals of impervious non-absorptive material to which there are no angles or surfaces that cannot be easily cleaned, and which, if fitted with a good automatic flushing tank, are extremely satisfactory, and give rise to no offensive conditions.

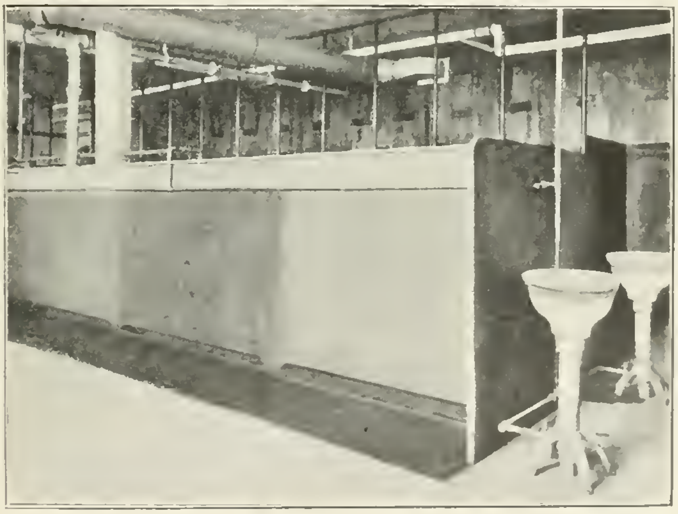
The question of dividing the urinal up by slate partitions is one upon which there is some diversity of opinion. On sanitary grounds the gain in cleanliness is considerable, as there are no corners that are difficult to get at, and the whole surface can be kept easily flushed. In the schools in Boston, U.S.A. (see Figs. 450, 451), they do not

* School Architecture, E. M. Wheelwright. 1901.

provide them, and in their Annual Report for 1904 the Schoolhouse Department strongly advise their omission, at all events in the Primary

450. THE OFFICES OF A BOSTON SCHOOL, U.S.A.

or Elementary Schools. The Board of Education, in their rules upon school building, do not say anything as to the need for such divisions,



451. URINALS AND DRINKING FOUNTAINS IN A SCHOOL IN BOSTON, U.S.A.

though on grounds other than sanitary there is much to be said for their provision.

The urinals in country schools are commonly the most unsatisfactory feature of the place; in many parts water in sufficient quantities for really effective flushing is hard to get, and reliance has to be placed upon collected rain water, a supply that is naturally most likely to fail when most required. A more or less satisfactory result can be obtained by the use of a galvanised iron trough, with a fall towards a large tank or box of dry earth; this trough will require cleaning with disinfectants at tolerably frequent intervals.

It should be borne in mind that the urinal is the really important part of the boys' offices. The closets, it will often be found, will not be used perhaps once a week, so that, while the number of these is not a matter of very great importance, there should be an ample supply of urinal accommodation, so arranged with an ingress at one end and an exit at the other to avoid crowding, as it generally happens that there are large numbers requiring to use it at one time.

APPENDICES.

RULES ISSUED BY THE BOARD OF EDUCATION FOR PLANNING AND FITTING UP SCHOOLS,

AND

EDUCATION ACT, 1902.

A. RULES OF ELEMENTARY SCHOOLS.

B. RULES OF SECONDARY SCHOOLS.

C. RULES OF BLIND AND DEAF SCHOOLS.

D. EDUCATION ACT, 1902.

APPENDIX A.

BOARD OF EDUCATION, WHITEHALL.

THE BUILDING REGULATIONS:

BEING PRINCIPLES TO BE OBSERVED IN

PLANNING AND FITTING UP NEW BUILDINGS FOR PUBLIC ELEMENTARY SCHOOLS,

TOGETHER WITH RULES AS TO CONSTRUCTION, AND CERTAIN REQUIREMENTS AS TO PLANS.

CONTENTS.

Appendix A.

BOARD OF EDUCATION, WHITEHALL.

THE BUILDING REGULATIONS:

BEING PRINCIPLES TO BE OBSERVED IN

PLANNING AND FITTING UP NEW BUILDINGS

FOR

PUBLIC ELEMENTARY SCHOOLS,

TOGETHER WITH RULES AS TO CONSTRUCTION,

AND CERTAIN REQUIREMENTS AS TO PLANS.

Prefatory Note.

(1.) *New Buildings.*—The chief aim of these Regulations is to secure that buildings newly erected for use as Public Elementary Schools shall be satisfactory for their special purpose.

Part I. relates to the particular questions which arise in designing a school as a place of instruction, and to the principles on which a building should be arranged and fitted in order to secure conditions favourable to effective teaching.

Part II. relates to the construction of the fabric, to the sanitary and other hygienic conditions, and to the safety of the scholars in case of fire or panic.

Part III. relates to the submission of plans in proper form for consideration by the Board of Education.

Part I. sets forth principles which embody the result of the experience of the Board of Education. These are intended to assist Local Education Authorities, School Managers, and their Architects, in providing schools which shall be compact, properly sub-divided for class teaching, conveniently arranged for effective supervision by the Head Teacher and for the movement of the children from the entrance to the class-rooms or from one class-room to another, and, as regards the several rooms, properly fitted for the instruction to be given

in those rooms. These sections have been framed with a view to the combination of economy with efficiency.

Part I. is not meant to restrict liberty of treatment so far as that is consistent with the observance of the Rules in Part II. If therefore a Local Education Authority, or any other body of school promoters, desires to arrange a School on lines which are not entirely in accordance with the principles of school planning as set out in Part I., the Board will be prepared to consider other arrangements of the various parts of the building, provided there is good reason to suppose that an efficient building for teaching purposes will thereby be forthcoming.

The Rules of Part II. deal with the extent of the site, with the solidity of the fabric, with the lighting, warming, drainage, ventilation, cloak-rooms and sanitary arrangements, and with the adequacy of the entrances and staircases in view of the use of the building by a large number of children. These matters have an important bearing on the health and safety of the scholars, and unless there are circumstances of an exceptional nature no newly erected building which does not conform with the Rules of Part II. will be recognised for use as a Public Elementary School.

(2.) *Existing Buildings.*—These Regulations do not constitute a standard by which existing premises can be judged; and they are plainly unsuitable for any rigid application to proposals for enlarging or otherwise improving existing buildings. Such cases must be dealt with individually as they arise, having reasonable regard to the principles set forth in these Regulations.

(3.) *Loans.*—A Circular issued by the Local Government Board on Loans in respect of Public Elementary Schools is printed as an Appendix to these Regulations.

ROBERT L. MORANT,
7th July 1905.

PART I.

PRINCIPLES TO BE OBSERVED IN PLANNING AND FITTING NEW BUILDINGS FOR PUBLIC ELEMENTARY SCHOOLS.

Section 1.—GENERAL.

Before an architect is instructed to prepare plans for a new building for use as a Public Elementary School, careful consideration should have been given to various points which have an important bearing on the character of the building which is required in the particular case.

The principal factors to be considered are the respective numbers of boys and girls for whom it has been determined that provision is necessary. The distribution of these scholars in respect of age is also very important in its bearing on organisation, and consequently on planning; the type of building required

will probably depend to some extent on the manner in which the Local Education Authority have exercised their discretion as to the exclusion of children who are under five years of age; and the nature of the accommodation required in the upper departments of ordinary Public Elementary Schools will be affected if Higher Elementary Schools are provided in the locality.

It must be remembered that a Head Teacher can seldom undertake effectively the responsibility for more than four to five hundred scholars, including the supervision of the teaching staff required for that number. This, therefore, is the greatest number of scholars for whom provision can wisely be made in one and the same department, remembering that each department must have its own Head Teacher, who is responsible for the general control and supervision of the instruction and discipline of that department (Article 8 of the Code).

The number of departments on any one site will depend upon the total number of scholars for whom provision is required, but it will be very seldom that more than three departments (or four, if one of them is for boys and girls of seven to nine or ten years of age) could properly occupy parts of one and the same building. When a school comprising departments for boys, girls, and infants is attended by all the children of the area for which it is available, it is not unusual to find that the average attendance in each department is much the same; and this fact will be a guide in planning a building for these conditions. But it is desirable to have a certain margin of places in the Infants' Department in order to meet the greater variability of the attendance at different seasons.

All these considerations should be kept in mind in deciding how many places should be provided in the several departments of a large school. But in every case the local circumstances must be carefully considered, and if children under five years of age are excluded, or if many of those who reach the age of twelve years are transferred to schools of a higher grade, or if other special circumstances exist, the proportions above suggested must be considerably modified.

The number and circumstances of the scholars who will attend in each department (if more than one be contemplated), and the number and qualifications of the teaching staff to be employed in each, will determine approximately the grouping of the scholars for teaching, the number of rooms which should be provided in the building, and the number of places in the several rooms. The rooms must be grouped compactly and conveniently so as to secure proper organisation and supervision; every building intended for use as a Public Elementary School must be planned so that the children who will attend can be seated in the best manner for being taught. It is important to remember that the number of places provided in any room depends not merely on its area, but also on the lighting, the shape of the room (especially in relation to the kind of desk proposed), and the position of the doors and fireplaces, which should be arranged so as to allow the whole of one side of any room to be left free for the groups of desks.

For large departments containing from 350 to 500 places the most suitable plan is that of a central hall with the class-rooms grouped round it. As a rule such a department would require from seven to ten class-rooms. Smaller depart-

ments may be planned conveniently with the class-rooms opening from a corridor, and a similar plan may be adopted even for larger departments. For small schools a school-room with one or more class-rooms will be sufficient. There should always be at least one class-room, except in special cases.

Where the site is sufficiently large, open, and fairly level, the most economical plan is that in which all the rooms are on the ground floor, and this arrangement is preferable on educational grounds. It is desirable that a building for use as a Public Elementary School should be on not more than two floors. A building on three floors is open to many objections, though it may be necessary in special circumstances, as, for example, on a site where land is very costly, or where it is otherwise impossible to get adequate area for playgrounds.

Section 2.—CENTRAL HALLS.

When there is a central hall it should have a floor space of not more than 4 sq. ft. for each scholar for whom the school is recognised; about $3\frac{1}{2}$ sq. ft. for each scholar will be sufficient. The hall must be fully lighted, warmed, and ventilated.

(*a*.) A single central hall may be provided for the joint use, at separate times, of two departments, provided that it is so placed as to be readily accessible from the class-rooms of each department.

(*b*.) Where outdoor space is not available, physical training should be given in the central hall (or corridor). This purpose should be taken into consideration at the time when the building is planned. Since fixed gymnastic apparatus is unsuitable for children under fourteen years of age, a separate gymnasium is not required, and cannot be approved.

Section 3.—CORRIDORS.

Large schools not built with a central hall must be provided with a wide corridor giving access to the rooms; and two or three of the rooms ought to be divided from one another by movable partitions only, so that on occasions one large room may be available.

A corridor should be fully and directly lighted and ventilated, and from 8 to 12 ft. wide, according to the size of the school.

Section 4.—SCHOOL-ROOMS.

Where a school-room is the principal room in a school which has neither central hall nor corridor it should never be designed for more than 100 children, and a room of even smaller size is desirable. The width should vary according to the kind and arrangement of the desks (Section 6).

No school-room lighted from one side only can be approved. The gable ends should be fully utilised for windows, and there should be no superfluous windows opposite the teacher.

When a school consists of a single room, that room should not contain more than 600 sq. ft. of floor space.

Section 5.—Class-rooms.

The number of class-rooms should be sufficient for the size and circumstances of the school.

(*a.*) The class-rooms should not be passage-rooms from one part of the building to another, nor from the school-rooms to the playground or yard. Both school-rooms and class-rooms must have independent entrances. The rooms should be arranged so that each can be easily cleared without disturbing the work proceeding in any other room.

(*b.*) A class-room should not be planned to accommodate more than from 50 to 60 children; but in special cases somewhat larger rooms may be approved. In the absence of supplementary light the measurement from the window-wall in a room 14 ft. high should not exceed 24 ft. 8 in. Except in very small schools class-rooms should not be planned for less than twenty-four scholars.

(*c.*) The proportions of class-rooms should vary with the kind and arrangement of the desks; but a long and narrow room should always be avoided, and a room approximating to a square is most satisfactory.

Section 6.—Desks.

Seats and desks should be provided for all the children, graduated according to their ages, and placed at right angles to the window-wall. (*See also* Section 4 and Rule 6, Part II.) The seats should be fitted with backs.

An allowance of 18 in. per scholar at each desk and seat will suffice (except in the case of the dual desk), and the length of each group should therefore be some multiple of 18 in., with gangways of 18 in. between the groups and at the walls. In the case of the dual desk the usual length is 3 ft. 4 in., and the gangways 1 ft. 4 in.

(*a.*) In an ordinary class-room five rows of long desks or six rows of dual desks are best; but in a school-room or room providing for more than sixty children, there should not be more than four rows of long desks or five rows of dual desks.

If a school-room is 18 ft. wide, three rows of long desks or four of dual desks may be used; if the width is 22 ft., the rows may be four and five respectively.

Long desks should be so arranged that the teacher can pass between the rows. Where dual desks are used this is not necessary, as the gangways give sufficient access; but the teacher should be able to pass behind the back row.

(*b.*) The desks should be very slightly inclined. An angle of 15° is sufficient. The objection to the flat desk is that it has a tendency to make the children stoop. A raised ledge in front of a desk interferes with the arm in writing. The edge of the desk when used for writing should be vertically over the edge of the seat.

(*c.*) Single desks are not necessary in an ordinary Public Elementary School.

Section 7.—Accommodation.

The accommodation of the school, *i.e.*, the number of places for which the school is finally recognised, will depend in part on the arrangement of the desks,

which must be approved by the Board. (*See* Section 6, Part I. of these Regulations and Article 17 (*c*) of the Code.)

No central hall or corridor, and no class-room for cookery, laundry, handicraft, drawing, or science, will be counted towards the accommodation.

When the building to be erected is for the use of older scholars the plans of the school-room (if any) and class-rooms must show an average of not less than 10 sq. ft. of floor space for each place proposed to be provided.

Section 8.—Infants' Schools.

Infants should not, except in very small schools, be taught in the same room with older children, as the methods of instruction suitable for infants necessarily disturb the discipline and instruction of the other scholars. Access to the infants' room should never be through the older children's school-room.

(*a.*) It is desirable that the partition between an infants' room and any other school-room or class-room should be impervious to sound, and there should be no habitual means of direct communication other than an ordinary door.

(*b.*) An Infants' School and playground should always be on the ground floor.

(*c.*) No infants' class-room should accommodate, as a rule, more than sixty infants.

(*d.*) A space in which the children can march and exercise should be provided. A corridor intended for this purpose should not be less than 12 ft. wide.

(*e.*) The babies' room should always have an open fire, and should be maintained at a temperature of not less than 60°.

(*f.*) In Infants' Schools an allowance of 16 in. per child at long desks will be sufficient. Dual desks should be 3 ft. long.

(*g.*) The accommodation of the school, *i.e.*, the number of places for which the school is finally recognised, will depend in part on the arrangement of the desks which must be approved by the Board. (*See* Section 6 and Article 17 (*c*) of the Code.)

No central hall or corridor will be counted towards the accommodation.

When the building to be erected is wholly for the use of infants the plans of the school-room (if any) and class-rooms must show an average of not less than 9 sq. ft. for each place proposed to be provided.

(*h.*) Where an infants' class-room is attached to a school for older children, and there is no corridor or hall available, it is desirable that the class-room should have a larger floor space than 9 sq. ft. per child, and that provision should be made of sufficient space, free of desks, for exercise. This space should extend across the room, and be not less than 12 ft. wide.

Section 9.—Rooms for Cookery, Handicraft, &c.

As a rule a single room for cookery, or laundry work, or handicraft, or science, or drawing, will serve for more than one school if provided as a centre in a convenient position. Every such centre should have its own lavatory and cloak-room.

Large schools, or schools of an exceptional type, may sometimes require special rooms for their exclusive use.

(*a.*) *Cookery Centres.*—A cookery centre should be capable of accommodating 12 to 18 at practice or 36 to 54 at demonstration at any one time. The larger size will require 750 superficial ft. and 10,500 cub. ft. Provision for instruction in scullery work is necessary.

The sink should be placed in full view of the teacher and children, and should be fitted with a cold water supply and a waste-pipe.

There should also be a gallery or raised platform, with desks to accommodate 36 to 54 children, according to the size of the room.

The floor space for practical work should afford about 20 sq. ft. for each scholar, and should not be encumbered with desks, cupboards, or stoves.

In cookery-rooms the ventilation needs special arrangements. Where a gas-stove is used it may be necessary to have a pipe fixed to carry off noxious fumes. The temperature should not be allowed to rise above 70°.

The apparatus for lessons in cookery should include such stoves and other appliances as are usually found in the homes of the children.

(*b.*) *Laundry Centres.*—A laundry centre should be of simple construction, and entirely apart from the ordinary school buildings.

The proper size for a laundry is about 750 sq. ft. It should have a gallery or raised platform with desks for forty-two children.

Laundry tables should be large enough to allow at least 3 ft. of space for each child when ironing.

The ventilation of rooms for laundry work needs special arrangements for the removal of steam.

(*c.*) *Handicraft.*—In its plan, arrangements, construction, lighting, and ventilation, a room for teaching handicraft should be modelled on a workshop rather than on a school. The construction should accordingly be simple. The roof may be either of lean-to or other ordinary form, according to circumstances. Its height at the windows in front of the benches need not be more than 10 ft. The light must be ample. The temperature should not be so high as in an ordinary class-room. A flat ceiling is not, as a rule, necessary. Ample ventilation should be provided by inlets at a height of 5 ft. from the floor, and by outlets at the highest point. A room for twenty scholars should have a floor space of about 700 sq. ft.

(*d.*) *Science-room.*—With the sanction of the Board a room for elementary practical work in science may be provided for the use of one large or several contributory schools. Such a science-room, if approved, should not, as a rule, contain more than 600 sq. ft. of floor space. It should be suitably fitted for the instruction to be given in it, and, where necessary, a fume closet may be provided.

In addition to a science-room, one of the ordinary class-rooms may be fitted with a simple and suitably fitted demonstration table. But a special lecture-room is not necessary in an ordinary Public Elementary School.

(*e.*) *Drawing Class-rooms.*—A drawing class-room can be sanctioned only if it is likely to be used for a reasonable time every week by the scholars from one large or several contributory schools. A suitable size for such a room is 600

sq. ft. of floor space. Light should be admitted at a suitable height and angle from the north, north-east, or east.

Section 10.—Higher Elementary Schools.

A Higher Elementary School should in general be planned in accordance with the principles applicable to an ordinary Public Elementary School, but it is important that the curriculum of the school should have been determined, and that it should have been generally approved by the Board, before an architect is instructed. Attention is directed to the following points of importance :—

(1.) For a Higher Elementary School accommodating from 300 to 350 scholars, 8 to 10 class-rooms will generally be required, since every class should have its own class-room. No class-room should accommodate more than forty scholars.

(*a*.) The class-rooms may be furnished with single or dual desks as may be desired. If single desks are adopted, a class-room should have an area of about 15 sq. ft. per scholar. Class-rooms fitted with dual desks need not be so large, but a minimum of about 12 sq. ft. per scholar will be requisite.

(2.) There must be available for use by the scholars of a Higher Elementary School special rooms of suitable size and proper equipment, if any such are required for giving the instruction which is provided in the approved curriculum. If special rooms are otherwise available, they need not be provided in the building of the Higher Elementary School ; but if special instruction is to be given elsewhere than in the building occupied by the Higher Elementary School, full information must be furnished, when the plans are submitted, showing that the needs of the scholars will be properly met.

(*a*.) If cookery, laundry work, or handicraft is to be taught in the school building, the room in which each is to be taught should be provided in accordance with Section 9.

(*b*.) If advanced drawing is taught in the school a drawing class-room is desirable. It should provide 30 sq. ft. of floor space for each scholar who will be taught in it at any one time. If the school has a suitably lighted central hall, that would answer for a drawing class-room, but no class other than a drawing class should be taught in a central hall.

(*c*.) (i.) A laboratory, if included in the building, should afford 30 sq. ft. of floor space for each scholar who will be instructed in it at any one time.

(ii.) A laboratory must have suitable tables. These should be well lighted, and should be fitted as required for the experimental work included in the approved curriculum. If chemistry is taught, the laboratory should have sinks, cupboards, and the necessary fume closets.

(*d*.) (i.) If there is a separate lecture-room it should be fitted with a suitably furnished demonstration table. If chemistry is to be taught, the lecture-room, if any, should have a fume closet.

(ii.) If chemistry or physics is taught and there is no separate lecture-room, one or more of the class-rooms may have a suitable demonstration table, and a fume closet if chemistry be taught.

(iii.) A small preparation room may be provided near the lecture-room, or other room used for the purpose, in schools where science is taught.

Section 11.—Teachers' Rooms.

In large schools there should be provided for the use of the teachers a small room or rooms with suitable lavatory accommodation. A store-room for books and other school material should adjoin the Teachers' room.

Section 12.—Teacher's House.

The residence (if any be provided) for the Master or Mistress should contain a parlour, a kitchen, a scullery, and three bedrooms; and the smallest dimensions which the Board can approve are—

For the parlour - -	14 ft. by 12 ft.	of	9 ft. in height to wall-plate.
For the kitchen - -	12 ft. by 12 ft.	super-	9 ft. in height to wall-plate.
For one of the bedrooms	14 ft. by 12 ft.	ficial	8 ft. if ceiled at wall-plate; or 7 ft.
For two other bedrooms	12 ft. by 8 ft.	area.	to wall-plate, and 9 ft. to ceiling.

(*a.*) The residence must be so planned that no room is a passage room, and that the chimneys are not all on the external walls.

(*b.*) There must be no internal communication between the residence and the school.

(*c.*) Windows should be carried up as nearly to the ceiling as practicable.

(*d.*) There must be a separate and distinct yard, with offices.

(*e.*) No dwelling-house should be built as part of the schoolhouse.

PART II.

RULES AS TO THE HYGIENIC AND SANITARY CONDITIONS OF THE PREMISES, THE CONSTRUCTION OF THE FABRIC, AND THE SAFETY OF THE SCHOLARS IN CASES OF EMERGENCY.

Rule 1.—Sites and Playgrounds.

In planning a school care must be taken to secure that there shall be an open airy playground proportioned to the size and needs of the school, and the site should, if possible, have a building frontage suitable to its area. A site open to the sun is especially valuable for the children, and important in its effects on ventilation and health. The minimum size of site is, in the absence of exceptional circumstances, a quarter of an acre for every 250 children, irrespective of the space required for a teacher's or caretaker's house, or for a cookery or other centre. If the school is of more than one story, this area may be proportionately reduced; but a minimum unbuilt on or open space of 30 sq. ft. per child should be preserved.

(*a.*) Except in the case of very small schools, playgrounds should be separate for boys and girls, and should, where practicable, have separate entrances from the road or street.

(*b.*) All playgrounds should be fairly square, properly levelled, drained, and enclosed. A portion should be covered, having one side against the boundary wall. A covered-way should never connect the offices with the main building; buttresses, corners, and recesses should be avoided.

(*c.*) An Infants' School should have its playground on the same level as the school, and a sunny aspect is of special importance.

Rule 2.—Walls, Floors, and Roofs.

The walls of every room used for teaching, if ceiled at the level of the wall-plate, must be at least 12 ft. high from the level of the floor to the ceiling; if the area of the room exceed 360 sq. ft., the height must be not less than 13 ft., and if it exceed 600 sq. ft., then the height must be at least 14 ft.

(*a.*) The walls of every room used for teaching, if ceiled to the rafters and collar beam, must be at least 11 ft. high from the floor to the wall-plate, and at least 14 ft. to the ceiling across the collar beam.

(*b.*) Great care should be taken to render the roofs impervious to cold and heat.

(*c.*) Roofs open to the apex are very undesirable. They can be permitted only where the roofs are specially impervious to heat and cold, and where apex ventilation is provided. Iron tie-rods are least unsightly when placed horizontally.

(*d.*) In the case of a school of more than one story especial care must be taken to render the floors as far as possible sound-proof.

(*e.*) The whole of the external walls of the school and residence (if any) should be solid. If of brick, the thickness must be at least one brick and a half; and if of stone, at least 20 in.; where hollow walls are proposed, the external wall must be 9 in. thick, with a 4½-in. lining and a 2-in. cavity.

(*f.*) The Board are only prepared to sanction the erection of schools of a lighter construction, *e.g.*, in iron and wood, or other suitable material, in very special circumstances, as for example in colliery districts where, owing to mining operations, there is no site available upon which a building of the ordinary solid type can be safely erected; or where the population is not of a stationary character, as, for example, during the progress of a large piece of engineering work, or in the neighbourhood of a mine likely to be soon worked out, or where temporary accommodation is required during the building of a new school, or the reconstruction of an old one.

Where such buildings are proposed special care must be taken to ensure the comfort of the children with regard to warmth and ventilation.

(*g.*) All walls, not excepting fence walls, should have a damp-proof course just above the ground line.

(*h.*) The vegetable soil within the area of the building should be removed, the whole space covered by a layer of concrete not less than 6 in. thick, and air-

bricks inserted in *opposite* walls to ensure a through current of air under floors for ventilation to joists.

(*i.*) Timber should be protected from the mortar and cement by asphalt or tar.

Rule 3.—Entrances.

Entrances should be separate for each department and each sex. In large schools more than one entrance to each department is desirable. (*See also* Rule 4.) Entrance doors should open outwards as well as inwards. A porch should be external to the school-room. An external door, having outside steps, requires a landing between the door and the threshold.

Rule 4.—Staircases.

There must be separate staircases for boys and girls, and each department should have its own staircases.

Every staircase must be fireproof, and external to the halls, corridors, or rooms. Triangular steps or "winders" must not be used. Each step should be about 13 in. broad, and not more than $5\frac{1}{2}$ to 6 in. high. The flights should be short, and the landings unbroken by steps. The number of staircases must be sufficient not only for daily use, but also for rapid exit in case of fire or panic. For any upper floor accommodating more than 250 a second staircase is essential.

Rule 5.—Cloak-rooms and Lavatories.

Cloak-rooms should not be passages, and should be external to the school-rooms and class-rooms. Cloak-rooms should be amply lighted from the end, and should not be placed against the gable wall, which should be fully utilised for windows giving light to the rooms used for teaching. (*See* Section 4, Part I.) There should be separate ingress and egress so that the children can enter and leave the cloak-room without confusion or crowding. There should be gangways at least 4 ft. wide between the hanging rails. Hat pegs should be 12 in. apart, numbered, and of two tiers. The lineal hanging space necessary to provide a separate peg for each child is thus 6 in. The hat pegs should not be directly one above the other.

Thorough ventilation and disconnection are essential, so that smells are not carried into the school. Ample space is needed immediately outside a cloak-room.

Lavatory basins are needed (*see* Rule 9 (*g*)). Girls' Schools require a larger number than boys' or infants'.

A lock-up slop-sink, water-tap, and cupboard are desirable for the caretaker.

Rule 6.—Lighting.

Every part and corner of a school should be well lighted. The light should, as far as possible, and especially in class-rooms, be admitted from the left side of the scholars. This rule will be found greatly to influence the planning. (*See* Rules 6 (*b*) and 7 (*a*) and Section 4, Part I.) All other windows in class-rooms should be regarded as supplementary or for ventilation. Where left light is impossible, right light is next best. Windows full in the eyes of

scholars cannot be approved. Unless the top of the windows be more than 14 ft. above the floor the plan should show no space more than 24 ft. from the window-wall in any room used for teaching. (*See* Section 5 (*b*), Part I.)

(*a.*) Windows should never be provided for the sake merely of external effect. All kinds of glazing which diminish the light and are troublesome to keep clean and in repair must be avoided. A large portion of each window should be made to open for ventilation and for cleaning.

(*b.*) The sills of the main lighting windows should be placed not more than 4 ft. above the floor; the tops of the windows should, as a rule, reach nearly to the ceiling; the upper portion should be made to swing. The ordinary rules respecting hospitals should here be remembered. Large spaces between the window-heads and ceiling are productive of foul rooms.

(*c.*) Skylights are objectionable. They cannot be approved in school-rooms or class-rooms. They will only be allowed in central halls having ridge or apex ventilation.

(*d.*) The colouring of the walls and ceilings and of all fittings in the rooms should be carefully considered as affecting the light. This point and the size and position of the windows are especially important in their bearing on the eyesight of the children.

(*e.*) The windows should be properly distributed over the walls of the class-rooms so that every desk shall be sufficiently lighted. The glass line of the window furthest from the teacher should be on a line with the back of the last row of desks.

Rule 7.—Ventilation.

The chief point in all ventilation is to prevent stagnant air; particular expedients are only subsidiary to this main principle.

There must be ample provision for the continuous inflow of fresh air, and also for the outflow of foul air. The best way of providing the latter is to build to each room a separate air chimney carried up in the same stack with smoke flues. An outlet should be by a warm flue or exhaust, otherwise it will frequently act as a cold inlet. Inlets are best placed in corners of rooms furthest from doors and fireplaces, and should be arranged to discharge upwards into the room. Gratings in floors should never be provided. Outlets in ceilings must not open into a false roof but must be properly connected with some form of extract ventilator.

The size of the inlets and outlets must be carefully adapted to the method of ventilation proposed. A much larger area is required when no motive force is provided.

It is as well that the windows should have both the top and bottom panes arranged to open inwards as hoppers.

Besides being continuously ventilated by the means above described, rooms should as often as possible be flushed with fresh air admitted through open windows and doors. Sunshine is of particular importance in its effects on ventilation, and also on the health of children.

(*a.*) Although lighting from the left hand is considered so important, ventilation demands also the provision of a small swing-window as far from the lighting as possible, and near the ceiling.

Rule 8.—Warming.

The heat should be moderate and evenly distributed so as to maintain a temperature of from 56° to 60°. When a corridor or lobby is warmed, the rooms are more evenly dealt with, and are less liable to cold draughts. Where schools are wholly warmed by hot water, the principle of direct radiation is recommended. In such cases open fireplaces in addition are useful for extra warming on occasions, and their flues for ventilation always.

(*a.*) A common stove, with a pipe through the wall or roof, can under no circumstances be allowed. Stoves are only approved when—

(i.) provided with proper chimneys (as in the case of open fires);

(ii.) of such a pattern that they cannot become red-hot, or otherwise contaminate the air;

(iii.) supplied with fresh air, direct from the outside, by a flue of not less than 72 in. super.; and

(iv.) not of such a size or shape as to interfere with the floor space necessary for teaching purposes.

(*b.*) A thermometer should always be kept hung up in each room.

(*c.*) Fireplaces and stoves should be protected by fire-guards.

(*d.*) If a room is warmed by an open fire the fireplace should be placed, if possible, in the corner of the room in order to leave space for the teacher's desk and blackboard.

Rule 9.—Sanitary Arrangements.

Water-closets within the main school building are not desirable, and are only required for women teachers. All others should be at a short distance and completely disconnected from the school. Privies should be fully 20 ft. distant.

(*a.*) The latrines and the approaches to them must be wholly separate for boys and girls. In the case of a Mixed School this rule especially affects the planning. Boys and girls should not use the same passages or corridors; where such an arrangement is unavoidable, there must be complete supervision from the class-rooms by sheets of clear glass.

(*b.*) Each closet must be not less in the clear than 2 ft. 3 in. wide, nor more than 3 ft., fully lighted and ventilated, and supplied with a door. The doors should be at least 3 in. short at the bottom and at least 6 in. short at the top. More than one seat is not allowed in any closet.

(*c.*) The children must not be obliged to pass in front of the teacher's residence in order to reach their latrines.

(*d*.) The following table shows approximately the number of closets needed :—

	For Girls.	For Boys.	For Infants.	For Girls and Infants.
Under 30 children	2	1	2	2
,, 50 ,,	3	2	3	3
,, 70 ,,	4	2	3	4
,, 100 ,,	5	3	4	5
,, 150 ,,	6	3	5	6
,, 200 ,,	8	4	6	7
,, 300 ,,	12	5	8	8

There should be urinals in the proportion of 10 ft. per 100 boys ; urinals are required for infant boys. If the numbers in the school are not very large, offices common to girls and infants can be approved ; a proper proportion of the closets must then be made of a suitable height for infants.

(*e*.) Earth or ash closets of an approved type may be employed in rural districts, but drains for the disposal of slop and surface water are necessary. Cesspits and privies should only be used where unavoidable, and should be at a distance of at least 20 ft. from the school. [Building Form "A," which may be obtained on application, gives suggestions as to their construction and arrangement.]

(*f*.) Soil-drains must always be laid outside the building (on a hard even bottom of concrete) in straight lines with glazed stoneware pipes, carefully jointed in cement and made absolutely water-tight. A diameter of 4 in. is sufficient except for drains receiving the discharge of more than ten closets, when the diameter should be 6 in. The fall should never be less than 1 in 30 for 4-in., and 1 in 40 for 6-in. drains. An inspection opening or chamber should be provided at each change of direction so as to facilitate cleansing the drain without opening the ground. Every soil-drain must be disconnected from the main sewer by a properly constructed trap placed on the line of drain between the latrines and the public sewer. This trap must be thoroughly ventilated by at least two untrapped openings ; one being the 4-in. soil-pipe carried up full size above the roof, and the other an inlet pipe connected with the side of the trap furthest from the public sewer. Automatic flushing tanks are desirable where trough closets are used.

(*g*.) Waste pipes from sinks or lavatories should be first trapped inside and then made to discharge direct through an outer wall over a trapped gully.

Rule 10.—Water Supply.

In all schools adequate and wholesome drinking water must be available for the scholars.

In cases where it is not taken from the mains of an Authority or Company authorised to supply water, care must be taken to ascertain that the water proposed to be used is adequate in quantity, is of suitable character, and is not

liable to pollution in any way, as, *e.g.*, by surface drainage, or by leakage from sewers, drains, cesspools, or other receptacles.

Where water pipes are used they should be so laid or fixed as to be properly protected from frost, and so that in the event of their becoming unsound the water conveyed in such pipes will not be liable to become fouled, or to escape without observation.

There should be no direct communication between any pipe or cistern from which water is drawn for domestic purposes, and any water-closet or urinal.

All water-closets and urinals should be provided with proper service cisterns, which, together with the outlet therefrom, should be capable of providing a sufficient flush.

Any cistern to be used for the storage of water should be watertight and be properly covered and ventilated, and should be placed in such a position that the interior thereof may be readily inspected and cleansed.

PART III.—PLANS.

Submission of Plans.

Before recognising newly erected premises as suitable for a Public Elementary School the Board must be satisfied by the submission of plans, drawn in accordance with the prescribed requirements, that the Building regulations are complied with.—(Article 17 of the Code.)

N.B.—The promoters of Schools must take their own measures to secure that their plans are in order under any Bye-Laws which may be in force in the district in which the School is situated.

Plans relating to Public Elementary Schools, and correspondence on such plans, should invariably be addressed to the Secretary, Board of Education, Whitehall, London, S.W., and not to any officer of the Board by name.

Plans must, except in special circumstances, be submitted to the Board through the Local Education Authority, unless that Authority has approved the direct submission of plans to the Board by an architect or by the Managers. In such cases the covering letter should refer to the direction or approval of the Local Education Authority, and failing this the Board may decline to consider the plans.

Requirements.

(*All plans, whether for new buildings or for improvements to existing buildings, must be submitted in accordance with the requirements which follow: plans which do not fully comply with these requirements cannot be considered.*)

I. A Block Plan of the Site, drawn in ink to a scale of 20 ft. to an inch. This plan must indicate—

(*a.*) The position of the School buildings.
(*b.*) Out-buildings.
(*c.*) Playground.

(*d.*) Drains (collateral and main), with their fall and depth below ground.
(*e.*) Entrances.
(*f.*) Boundary walls or fences, and their nature.
(*g.*) Roads.
(*h.*) The points of the compass.
(*i.*) The levels of the ground at the principal points.

N.B.—For approval of the site alone, the plan should show (*g*), (*h*), and (*i*).

II. A Plan of each Floor of the School-rooms (and Teacher's or Caretaker's House, if any) drawn in ink to a scale of 8 ft. to an inch. The internal fittings of the rooms (*fireplaces, groups of desks, &c.*) must be accurately shown. The plan should also state whether the rooms are intended for boys, girls, or infants.

In cases of enlargement, a plan showing the buildings as they exist is needed.

III. Sections and at least four Elevations, also drawn in ink to a scale of 8 ft. to an inch. The ceiling, the positions of window-heads in relation thereto, and the mode of ventilation must be shown.

N.B.—(*a.*) Pencil drawings cannot be received, but sketch plans or coloured tracings in ink on tracing cloth may be submitted while plans are in the preliminary stage of pencil, so that suggested alterations can be adopted without difficulty or expense. Such plans may be drawn to a scale of 16 ft. to 1 in. The Board's final approval will not in any case be given to preliminary plans, and the full plans described above will always be required.

(*b.*) Diagrams are of no value and cannot be accepted.

(*c.*) In the case of enlargements or alterations, the whole site and the existing building should be as accurately shown in every respect as the proposed changes, and in such a manner that any change of numbers can be ascertained.

(*d.*) All plans should be dated, the scales drawn on, and dimensions figured.

(*e.*) It is preferable that all plans should be submitted on linen tracing paper or other material which can be folded.

IV. A Section of the Desk proposed to be used, drawn to a scale of 1½ in. to a foot. (*See* Section 6, Part I.)

V. A Draft Specification.

VI. An Approximate Estimate of the total expenditure proposed.

PART IV.

Conditions of Recognition of New Buildings.

A newly erected building for which plans have not been approved or conditionally approved by the Board of Education before 1st October 1905 will not be recognised for use as a Public Elementary School, unless it is shown, by plans submitted in accordance with the requirements of Part III. of these Regulations, that the Rules of Part II. will be observed. In exceptional cases,

where special circumstances exist, the Rules of Part II. may be waived by the Board in some particulars. On any question arising under these Regulations the decision of the Board is final.

Newly erected buildings, unless for good reason, should be planned in accordance with the principles set out in the several sections of Part I., and the Board may refuse to recognise a School, if, in their opinion, these principles have been unnecessarily departed from.

Given under the Seal of the Board of Education this 7th day of July 1905, and presented to Parliament pursuant to the 97th section of the Elementary Education Act, 1870, to lie on the tables of both Houses of Parliament for one month.

ROBERT L. MORANT,
Secretary.

LOANS IN RESPECT OF PUBLIC ELEMENTARY SCHOOLS.

LOCAL GOVERNMENT BOARD,
WHITEHALL, S.W., 21*st September* 1903.

SIR,

I am directed by the Local Government Board to state that they have been in communication with the Board of Education with reference to the procedure to be adopted in connection with the borrowing of money by Local Education Authorities for the purchase of land and the provision of Public Elementary Schools.

Under the Code, the approval of the Board of Education is required to plans of Public Elementary Schools, so far as educational requirements are concerned, and it is therefore considered desirable that, in the first instance, Local Education Authorities should submit proposals for the acquisition of sites for such Schools, or for the erection of new buildings or extensions of existing buildings, to the Board of Education, and that any application to the Local Government Board for sanction to borrow money in connection with these matters should be deferred until the Board of Education have approved of the site or plans, so far as educational requirements are concerned.

Questions in regard to water supply or drainage will be dealt with by the Local Government Board.

Applications to the Local Government Board for sanction to loans should be accompanied by the following particulars :—

1. A copy, on tracing cloth, of each of the approved plans.
2. A detailed estimate of the expenditure in the form provided by the Board of Education. A copy of this form is enclosed.
3. A copy of the resolution of the Council directing the application for sanction to the loan required.
4. Full information as to the water supply available, and a certificate,

signed by the surveyor of the borough or district in which the School will be situate, to the effect that the plans comply with any bye-laws which are in force.

When the application to the Local Government Board relates merely to a loan for the acquisition of the site, the following particulars only will be required :—

1. A copy, on tracing cloth, of the plan of the approved site.
2. Information as to the terms of any agreement which has been entered into for the purchase of the site.
3. A copy of the resolution of the Council directing the application and giving the name of the proposed School.

In the case of all applications for sanction to loans the Board should be furnished with a statement showing—

(*a.*) The assessable* value of the county, borough, or district.

(*b.*) The outstanding balance of all loans transferred to or contracted by the Council for purposes of education.

(*c.*) The unused borrowing powers for purposes of education.

I am, Sir, your obedient servant,

S. B. PROVIS, *Secretary.*

The Clerk to the Local Education Authority.

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* In the case of a county the assessable value of the county after deducting the assessable values of any boroughs or urban districts the Councils of which are Local Education Authorities under Part III. of the Education Act, 1902, should be given. In the case of a borough the assessable value for the purposes of the Borough Rate, and, as regards urban districts, the assessable value to the Poor Rate. As to the meaning of the term "assessable value" see section 3 of the Agricultural Rates Act, 1896.

APPENDIX B.

BOARD OF EDUCATION.

BUILDING REGULATIONS FOR SECONDARY SCHOOLS AND PUPIL TEACHER CENTRES:

BEING PRINCIPLES TO BE OBSERVED IN

DESIGNING & FITTING UP NEW BUILDINGS, RULES AS TO CONSTRUCTION, ETC.,

AND

CERTAIN REQUIREMENTS AS TO PLANS, SPECIFICATIONS, AND ESTIMATES.

MARCH 1906.

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Appendix B.

BOARD OF EDUCATION.

BUILDING REGULATIONS FOR SECONDARY SCHOOLS AND PUPIL TEACHER CENTRES:

BEING PRINCIPLES TO BE OBSERVED IN

DESIGNING & FITTING UP NEW BUILDINGS, RULES AS TO CONSTRUCTION, ETC.,

AND CERTAIN REQUIREMENTS AS TO PLANS, SPECIFICATIONS, AND ESTIMATES.

MARCH 1906.

Prefatory Note.

THE primary aim of these Regulations is to secure that buildings which are newly erected for use as Secondary Schools or Pupil Teachers' Centres shall be thoroughly suitable for their special purpose.

These Regulations do not, therefore, constitute a standard by which existing premises can be judged ; and they are plainly unsuitable for any rigid application to proposals for enlarging or otherwise improving an existing building. Such cases will be dealt with on their merits, and as they arise ; but the authorities who are responsible for submitting schemes for the alteration of an existing building, in order that it may be used for a Secondary School or a Pupil Teachers' Centre, will do well to consider the principles here set out, and the Board will have reasonable regard to the principles of the Regulations in deciding whether their approval shall be given in such cases.

The Regulations are divided into three Parts, and the Board think it important that the promoters of schemes for building Secondary Schools should

appreciate the broad distinctions which it is possible to draw between the force of the several parts.

Part I. deals with the specific questions which arise in designing a place where instruction is to be given according to the Regulations for Secondary Schools, and in fitting up the premises in a manner that shall be conducive to effective teaching. The principles which are set out in Part I. are intended to assist Local Education Authorities, Governing Bodies, and Architects to provide premises which shall be compact, properly sub-divided for class teaching, well arranged for effective oversight by the Head Master or Head Mistress and for the movement of the scholars from one part of the School to another or from the entrance to the several Class-rooms, &c., and, as regards the several rooms themselves, properly fitted for the instruction to be given in those rooms. The Board, however, recognise that, owing to the wide differences between the various grades and kinds of Secondary Schools and Pupil Teachers' Centres, it is undesirable to attempt to lay down any hard and fast rules as to the actual method of planning to be adopted. Any variations from the principles here suggested will be carefully considered with regard to the particular purposes for which the building is intended to serve, and will be approved provided they can be shown to provide satisfactorily and effectively for the educational and other needs of the scholars.

For this purpose the Board will be prepared to report upon, and discuss with the promoters, schemes for new buildings for Secondary Schools while in a preliminary stage in any case where such a course seems advisable.

Part II. deals with the construction of the fabric, with the sanitary and other hygienic conditions, and with the safety of the scholars in case of emergency. Questions such as those of the solidity of the fabric, the lighting, warming, drainage and ventilation, the adequacy of the entrances and staircases in view of the use of the building by a large number of scholars, have, in addition to such directly educational importance as certain of them have, a bearing on the health of the scholars, and unless there are circumstances of a highly exceptional kind no newly erected building which does not comply with the rules of Part II. will be recognised for use as a Secondary School or Pupil Teachers' Centre.

Part III. deals with the submission to the Board in proper form of the plans and other materials which will be required for the proper consideration of any building scheme whether for erecting a new building or for altering an old one.

PART I.

PRINCIPLES TO BE OBSERVED IN DESIGNING AND FITTING UP NEW BUILDINGS FOR USE IN SECONDARY SCHOOLS OR PUPIL TEACHERS' CENTRES.

Section 1.—General.

Before any instructions are given to an architect to prepare plans for a new building careful consideration should be given to the proposed organisation of the School; the number of Masters or Mistresses to be employed; the probable size of the classes in the different parts of the School; the relative importance of the teaching of Science, Art, or Manual Work; the possibility of grouping sets of rooms conveniently for certain branches of the work, &c., so that the plan of the building may be fully adapted for the work to be done in the School.

It is important to remember that, as the actual numbers in a class can seldom be made to correspond closely with the various sizes of rooms provided, the nominal accommodation as shown by the plans should exceed the number for which the School is intended to provide. The custom of dividing up classes for different subjects again makes the provision of extra small class or division rooms desirable.

The rooms should be grouped compactly and conveniently in order to secure easy and effective supervision, and economy in working and maintenance. Generally speaking, in the case of Schools where the number of scholars is considerable, this result can most satisfactorily be secured by placing the Class-rooms on three sides of, and opening from, a Central Hall. In the case, however, of small Schools and those in which the Hall is made to serve for a variety of purposes, it is often found more convenient to separate the Class-rooms from the Hall in order to avoid disturbance.

Where more than one floor is necessary the upper rooms can be entered from a gallery which should be in full view of the Hall. As far as possible, passages and corridors should be avoided; if used, they must be large, airy, and well lighted.

The Class-rooms should have the upper panels of the doors glazed with clear glass, in order to facilitate inspection without disturbing the work in the room.

The accommodation of a room depends not merely on its area, but also on the lighting, position of the doors, fireplaces, and the general shape of the room.

Section 2.—Assembly Hall.

The Central or Assembly Hall should have a floor space of at least 6 sq. ft. for each scholar for whom the School is to provide

accommodation, and it is preferable that if the School be for less than 150 scholars a floor space of 8 sq. ft. per scholar should be provided.

Where no hall is provided there must be a large, well-lighted corridor giving access to the various rooms; this must be not less than 8 ft. wide in the case of small Schools, the width being increased with the size of the School. In these cases it is advisable that two adjacent Class-rooms should be so arranged that they can be thrown together to form a large room when required.

The Central or Assembly Hall should not be used as a Class-room, except for drawing. If it is found necessary to use the Hall as a Class-room, it must never be used for more than one class at once. A Central Hall occasionally used as a Class-room will not be counted in the accommodation for which the School is recognised.

Section 3.—Class-rooms.

In every School there must be Class-rooms at the rate of four for every 100 scholars. There must be in the Class-rooms, as distinct from the laboratories and other rooms, sufficient accommodation for the whole number of scholars for whom the School is intended to provide. A Lecture-room, however, if suitable for class teaching, may be counted as a Class-room for not more than 30 scholars. No Class-room should be designed for more than 30 or less than 15 scholars. Class-rooms should be fitted with single desks having a gangway of not less than 18 in. between each row and between the outer row of desks and the wall, 1 ft. between the last row of desks and the back wall, and a clear space extending the full width of the room of not less than 7 ft. 6 in. between the front row of desks and the wall for the teacher. The desks may be reckoned as occupying a space of about 3 ft. by 2 ft. in order to provide the requisite distance between the front of one and the back of that next in front of it.

To provide for this a floor area of from 17 to 18 sq. ft. will be required according to the size of the class.

In cases where it is found difficult to provide this amount the Board will be prepared to accept a minimum allowance of 16 sq. ft. per head, provided that the arrangement can be shown to be satisfactory. In this case the desks should be placed closer together in pairs, with a gangway of not less than 2 ft. between every two rows of desks. (For rules as to lighting, *see* Part II., Rule 6.)

Fireplaces.

Where fireplaces are provided they should be placed in the outer corner of the room, in order to avoid interference with the master's platform and blackboard.

Stepped seating should not be used.

Section 4.—Lecture-rooms.

A Lecture-room should accommodate not less than 30 scholars, and may be large enough to hold more; it should be constructed as far as possible on the principle of a theatre with rising seats. There must be a floor space of not less than 14 sq. ft. per scholar for the first 30 scholars, and 12 sq. ft. for each scholar above that number.

Windows must not be placed facing either the teachers or scholars.

Section 5.—Laboratories and Science Lecture-room.

Laboratories and Science Lecture-room.

In every School there must be one or more Laboratories, and there should be a Science Lecture-room, or a Class-room fitted for experimental demonstration. A Laboratory should accommodate not less than 15 nor more than 25 scholars at a time at practical work, but in Schools of more than 200 may accommodate more, if arrangements are made for supervision by more than one teacher at a time.

Thirty square feet of floor space are necessary for each scholar for whom provision is made in a Laboratory.

Laboratories should be thoroughly well lighted and properly fitted with benches for their special purpose, and supplied with water, gas, and, where possible, electric current. In a Chemical Laboratory there must be special provision, by way of fume closets, a hood over a bench, or otherwise, for experimental work involving noxious fumes. A Physical Laboratory should be free from vibration, and for that purpose placed on the ground floor where possible, and should be capable of being darkened. If there is no Balance-room a separate place in the Laboratory should be assigned for balances. If on an upper story, the floor should be free from vibration and impervious to sound. Store, Preparation, Balance, and Dark Rooms should be provided where possible.

Section 6.—Drawing and Art Rooms.

Drawing and Art Rooms.

In every School there should be a room or rooms properly constructed and fitted for the study of Drawing and Art, with accommodation for at least 15 Elementary and 15 Advanced Students. It is preferable, but not essential, that there should be a separate room for Advanced Drawing and Art. If the School is of more than one story such rooms must be at the top.

Thirty square feet of floor space are necessary for each scholar for whom provision is made in a Drawing or Art room.

The following dimensions will afford suitable provision for 50 scholars:—

(*a.*) One room for Elementary Drawing 25 ft. by 30 ft. It may be lighted by skylights as well as side windows.

(*b.*) One room for Advanced Drawing and Art not less than 25 ft. by 30 ft. This room should be lighted from the north side by a single large

window square at the top, to give as much light as possible. The window may be carried up in a dormer if necessary, and its top should be at a height from the floor equal to three-quarters the depth of the room.

The following equipment and apparatus should be provided:—

(*a.*) A sufficient number of single desks, with wire or other receptacles for holding pots or glasses of water, and movable appliances for the support of drawing copies.

(*b.*) A suitable boarded or other surface fitted round the walls at a convenient height for blackboard practice.

(*c.*) A rack with numbered compartments for drawing boards.

(*d.*) Stands for displaying casts and drawing models or objects.

(*e.*) A cupboard for storing examples and exercises.

(*f.*) A movable blackboard and a whiteboard with all requisites for demonstrations by teachers.

(*g.*) Some frames, glazed and with movable backs, for displaying examples of good Art work.

Section 7.—Cookery Class-rooms.

A Cookery Class-room should have 40 sq. ft. of floor space for each scholar to be taught at any one time.

Cookery Rooms.

In Cookery Class-rooms it is convenient to have two ranges, one open and the other closed, arranged on a slight cant across the angles at one end of the room, with a dresser between them. Where gas is available, a gas stove, provided with a flue to carry off fumes, should be fixed in a convenient position against the side wall, if possible in a line with the table to be used for demonstration purposes. Provision for scullery work must be made, and the sink should be placed in full view of the teacher and scholars. If floor space permits, raised benches should be placed at the end of the room opposite the ranges and dresser. Kitchen tables should be provided, allowing 2 ft. 6 in. square for the use of each scholar in classes for practical work. Special arrangements should be made for ventilation, and the temperature should not be allowed to rise above 70°. A Cookery-room should be so placed that smells from cooking will not be liable to enter other parts of the School. There should be accommodation for at least 15 scholars.

Section 8.—Workshops.

Workshops.

In every School there should be, and in every Boarding School with more than 20 boarders there must be, a Workshop or Manual Training Room, well lighted and ventilated, which should provide for not less than 15 nor more than 20 scholars under instruction at one time. The latter number will require about 700 sq. ft. of floor area. For metal-working there should be not less than 4 ft. run of bench for every scholar. For wood-working, benches about 5 ft. long by 2 ft. 6 in. wide are recommended. There should be a space of at least 4 ft. in width between benches, and a clear space round every bench for wood-working. A rack for tools should be provided for every bench.

In plan, arrangement, lighting, and ventilation the room should be modelled on a workshop rather than on a school. The construction may accordingly be simple. The roof may be of lean-to or other ordinary form. Its height at the windows in front of the benches need not be more than 10 ft. The light must be ample. A flat ceiling is not, as a rule, necessary, but ample provision must be made for the inlet of fresh air and extraction of foul air at the highest point.

Provision for blackboard teaching should be made.

Section 9.—GYMNASIUM.

In every School it is desirable that there should be a Gymnasium.

Section 10.—MUSIC-ROOMS.

In every School it is desirable to have a Music Class-room, and attached to it Practice-rooms about 8 ft. by 6 ft. 6 in. divided by sound-proof partitions, and with sound-proof doors. Music and Practice rooms if provided should be as much isolated as practicable. Music-rooms.

Section 11.—DINING-HALLS.

In every School there should be proper Dining-halls for day scholars as well as for boarders, if any, and careful estimates should be made of the number of day scholars who may be expected to dine. Not less than 2 ft. should be allowed for every scholar at the table, and not less than 10 sq. ft. of floor area. The Kitchen and necessary offices should be adjacent to the Dining-hall, with separate entrance, and so placed that smells from cooking will not be liable to enter the School. Dining-halls.

Section 12.—COMMON-ROOMS.

In every School there must be a Headmaster's or Headmistress's Room, and a Common-room for other Masters or Mistresses. Common-rooms.

In Pupil Teachers' Centres and other Schools where pupils come from a distance, it is very advisable to provide Common-rooms as well as dining-rooms.

In every Boarding School a Common-room for the use of Boarders out of School hours.

Section 13.—LIBRARY.

In every School it is desirable that there should be, and in every Boarding School of more than 20 boarders there must be, a room furnished for use as a Library. Library.

Section 14.—DORMITORIES.

If the scholars in a Boarding School sleep in dormitories there must be a space of not less than 3 ft. between beds. If the cubicle Dormitories.

system is adopted, there must be a window to every cubicle. In sleeping-rooms there should be floor space of 65 sq. ft., and cubic space of 800 cub. ft. for each scholar.

Masters' or Matrons' rooms should be placed so as to ensure some supervision over the dormitories. Lavatories should not be fitted in the dormitories.

Section 15.—Sick-rooms and Infirmaries.

Sick-rooms.

In every Boarding School there must be a Sick-room, properly isolated, with separate lavatory and latrine. In a Sick-room the beds must be free of the walls. There should be not less than 6 ft. space between beds, and, if possible, a window between every two beds, the windows being opposite each other. All internal angles of walls, floors, and ceilings should be rounded.

There must be a Sick-room 1,000 cubic ft. for each bed.

Water-closets and bathroom, with hospital bath, should be provided, with aerial disconnection from the Sick-room. In Boarding Schools of more than 50 boarders provision for infectious cases should be made in a separate building as far from the main building as conveniently practicable.

Section 16.—Headmaster's House.

Headmaster's House.

The Headmaster's house, if any, should be planned as a gentleman's residence, with accommodation for a family, and, especially in the case of a Boarding School, for the entertainment of visitors.

Headmistress's Rooms.

For the Headmistress in a Girls' School proper apartments with reception rooms should be provided.

Section 17.—Boarding-houses.

Boarding-houses.

In every School for more than 80 boarders, there should be separate houses with accommodation, unless under exceptional circumstances, for not more than 50 in each house, under the charge of a master.

PART II.

RULES AS TO THE HYGIENIC AND SANITARY CONDITIONS OF THE PREMISES, THE CONSTRUCTION OF THE FABRIC, AND THE SAFETY OF THE SCHOLARS IN CASES OF EMERGENCY.

Rule 1.—Sites, Playgrounds, or Playing Fields.

The site for a new School should be carefully selected with a view to its surroundings, in order to avoid noise and dust. The access to

it should be convenient. In towns the building should be kept well back from the street unless the position is a quiet one. There should, if possible, be a building frontage suitable to the area of the site.

A site open to the sun is especially valuable for the scholars in its effect upon ventilation and health. With regard to aspect the most suitable direction for the Class-rooms to face is south-east, east and south, the other quarters being as far as possible utilised for windows to corridor, staircases, cloak-rooms, assembly hall, &c.

The area of the site should be sufficient not only to provide adequate playground space, but also, if possible, room for cricket and football, or, in the case of Girls' Schools, hockey and lawn tennis. For this purpose it is desirable to secure from 3 to 4 acres for a small School, increasing with the size of the School and the extent to which such games are likely to be played. Area.

In any case there must be an open, fairly square, properly levelled, drained, and enclosed playground suitable to the size of the School, providing a clear unbuilt upon space of 50 sq. ft. per head, but in no case must the playground contain less than 750 sq. yards. Special consideration will be given to the case of Schools in large towns.

A part of the whole of this should be covered with asphalt or other suitable paving, in order to provide a suitable place for drilling, &c.

The playground should be given a warm, sunny aspect. Buttresses, corners, and recesses should be avoided.

There should be a covered shed for games on wet days. In dual or mixed Schools the playground should be separate for the two sexes.

Bicycle sheds should be provided.

Rule 2.—Walls, Floors, and Roofs.

The walls of every room used for teaching, if ceiled at the level of the wall-plate, must be at least 12 ft. high from the level of the floor to the ceiling.

(*a.*) The walls of every room used for teaching, if ceiled to the rafters and collar beam, must be at least 11 ft. high from the floor to the wall-plate and at least 14 feet to the ceiling across the collar beam.

(*b.*) Great care should be taken to render the roofs impervious to cold and heat.

(*c.*) Roofs open to the apex are very undesirable. They can be permitted only where the roofs are specially impervious to heat and cold, and where apex-ventilation is provided.

(*d.*) In the case of a School of more than one story especial care must be taken to render the floors as far as possible sound-proof. Solid floors should be used on the ground floor.

(*e.*) The whole of the external walls of the School and residence (if any) should be solid. If of brick the thickness must be at least one brick and a half; and, if of stone, at least 20 in. Where hollow walls are proposed, the external wall must be 9 in. thick, with a $4\frac{1}{2}$-in. lining, and a 2-in. cavity.

(*f.*) All walls, not excepting fence-walls, should have a damp-proof course just above the ground line.

(*g.*) The vegetable soil within the area of the building should be removed, the whole space covered by a layer of concrete not less than 6 in. thick, and air bricks inserted in *opposite* walls to ensure a through current of air under floors for ventilation to joists.

(*h.*) Timber should be protected from the mortar and cement by asphalt or tar.

(*i.*) Except where hard rock, gravel, or chalk bottom is found, concrete foundations must be provided under all new walls. They must be not less than a foot thick, nor project less than 6 in. beyond the lowest course of footings on either side.

Rule 3.—Entrances.

Entrances.

Entrances must not be direct into a Central Hall or other room; and must not be used as Cloak-rooms. For external doors having outside steps there should be a landing between door and steps. External doors should open outwards.

In Schools of more than 150 scholars there should be more than one exit.

In Mixed and Dual Schools there must be a separate entrance for boys and girls.

Rule 4.—Staircases.

Staircases.

Staircases must be not less than 4 ft. nor more than 6 ft. wide, and must not have more than fourteen steps to a flight. Where possible they should be constructed with solid walls on both sides of the flights, and every staircase must have at least one external wall. They must be of fire-resisting materials, and well lighted in every part. In Schools of more than 150 scholars with upstair rooms there must be at least two staircases.

Treads must be from 11 in. to 13 in. wide, and risers not more than $5\frac{1}{2}$ in. to 6 in. high; winders must be avoided.

Rule 5.—Cloak-rooms and Lavatories.

Cloak-rooms, Lavatories, and Changing-rooms.

In every School there must be Cloak-rooms, Lavatories, and Changing-rooms. They must not be passages. They should be entered from properly lighted and ventilated lobbies, and must not

be entered from any room used for teaching. They must be heated and ventilated so as to dry wet things and prevent any smells or damp from entering the School. Lavatory fittings should not be placed in Cloak-rooms.

In Mixed or Dual Schools there must be separate Cloak-rooms and Lavatories for boys and girls.

Cloak-rooms should be well lighted from the end. Gangways at least 4 ft. wide should be made between the hanging rails and seats. Pegs for hats and cloaks should be numbered, placed not less than 12 in. apart, and not placed one above another. In Lavatories, slate troughs, with loose, not fixed basins, are recommended. The number of lavatory basins in Day Schools should be one for every 10 scholars up to 100, and one for every 15 scholars above the first 100. The floors should be of asphalt or other impervious material, and the walls of glazed brick or tile, or with at least a dado of 5 ft. high of such materials. Glazed partitions should be used as far as possible. Changing-rooms should be provided with fixed seats, pegs, lockers, and boot-racks. In small Day Schools accommodation for changing may be provided in the Cloak-room.

A lock-up slop sink, water-tap, and cupboard are desirable for the caretaker.

Rule 6.—LIGHTING. (*See also under* CLASS-ROOMS.)

The area of window glass should approximate to one-fifth the area of the floor space in rooms used for teaching, and in other rooms not less than one-eighth. Windows.

Every part and corner of a School should be well lighted. The light in Class-rooms must be admitted from the left side of the scholars. (This rule will be found greatly to influence the planning.) All other windows in Class-rooms should be regarded as supplementary or for ventilation. Where left light is impossible right light is next best. Windows full in the eyes of scholars cannot be approved. Unless the top of the windows be more than 12 ft. above the floor the plan should show no space more than 20 ft. from the window wall in any room used for teaching.

(*a.*) Windows should never be provided for the sake merely of external effect. All kinds of glazing which diminish the light and are troublesome to keep clean and in repair must be avoided. A large portion of each window should be made to open for ventilation and for cleaning.

(*b.*) The sills of the main lighting windows should be placed not more than 4 ft. above the floor; the tops of the windows should as a rule reach nearly to the ceiling; the upper portion should be made to swing. The ordinary rules respecting hospitals should here be remembered. Large spaces between the window heads and ceiling are productive of foul rooms.

(c.) Skylights are objectionable. They cannot be approved in School-rooms or Class-rooms. They will only be allowed in Central Halls having ridge or apex ventilation.

(d.) The colourings of the walls and ceilings and of all fittings in the rooms should be carefully considered as affecting the light. This point and the size and position of the windows are especially important in their bearing on the eyesight of the children.

(e.) The windows should be properly distributed over the walls of the Class-rooms so that every desk shall be sufficiently lighted. The glass line of the window furthest from the teacher should be on a line with the back of the last row of desks.

Rule 7.—Ventilation.

Ventilation. In each room there must be, independently of doors and windows, inlets for fresh air and outlets for foul air, communicating with the outer air.

Inlets. Inlets should be placed as far as may be from doors and fireplaces. They must not consist of gratings in floors.

Outlets. Outlets for the extraction of foul air should be placed in such positions as are required by the system adopted.

Special attention must be paid to ventilation in Chemical Laboratories and Cookery-rooms.

Rule 8.—Warming.

Warming. Warming may be done either by open fire-grates (if possible arranged to admit fresh warm air), by hot-water pipes (in which case the principle of direct radiation is recommended), or by hot air. An even temperature of from 54° to 60° should be maintained.

Rule 9.—Closets.

Closets. (a.) In Day Schools there should be no closets in the main School building, except for women teachers and girls. All others should be completely disconnected from the School at a short distance.

In Mixed or Dual Schools the offices and approaches to them must be wholly separate for the two sexes.

The number of closets required in the case of Day Schools is 1 for every 15 girls for the first 100, 1 for every 25 above that number, 1 for every 25 boys, and 1 urinal for every 15 boys.

(b.) In Boarding Schools there should be closets near the Dormitories, but separated from them by cross-ventilated lobbies.

The number of closets required in the case of Boarding Schools is 4 for every 30 boarders for day use, and 1 for every 20 boarders for night use.

(*c.*) Each closet must be not less in the clear than 2 ft. 3 in. wide nor more than 3 ft., fully lighted and cross-ventilated. They are best divided by partitions carried up 6 ft. only. Doors, if any, should be separated from the threshold by at least 4 in., and from the head by at least 6 in.

(*d.*) If a cesspool system is unavoidable, the cesspool must be as far as possible removed from the playground, be fenced in, properly ventilated, and watertight. Cesspool.

Rule 10.—Drains.

The arrangement of drains should be in accordance with the best approved modern practice, subject to the regulations of the Local Sanitary Authority, or, if none, subject to those of the nearest Urban Sanitary District Authority. Drains.

Rule 11.—Bath-rooms.

In Boarding Schools two baths are required for every 25 boarders.

A good plan for baths is a room with a floor of asphalt, lead, or other impervious material, with taps and movable baths, or shower baths.

Rule 12.—Water Supply.

All Schools should be provided with an adequate supply of wholesome drinking water.

In cases where such supply cannot be obtained from the mains of an Authority or Company authorised to supply water, care must be taken to ascertain that the supply proposed to be adopted is adequate in quantity, is of suitable character, and is not liable to pollution in any way, as, *e.g.*, by surface drainage, or by leakage from sewers, drains, cesspools, or other receptacles.

All water pipes should be so laid or fixed as to be properly protected from frost, and so that, in the event of their becoming unsound, the water conveyed in such pipes will not be liable to become fouled, or to escape without observation.

There should be no direct communication between any pipe or cistern from which water is drawn for domestic purposes, and any water-closet or urinal.

All water-closets and urinals should be provided with proper service cisterns, which, together with the outlet therefrom, should be capable of providing a sufficient flush.

Any cistern to be used for the storage of water should be watertight and be properly covered and ventilated, and should be placed in such a position that the interior thereof may be readily inspected and cleansed.

PART III.—PLANS.

SUBMISSION OF PLANS.

Before recognising newly erected premises as suitable for a Secondary School the Board must be satisfied by the submission of plans, drawn in accordance with the prescribed requirements, that the Building Regulations are complied with.

N.B.—The promoters of Schools must take their own measures to secure that their plans are in order under any Bye-Laws which may be in force in the district in which the School is situated.

Plans relating to Secondary Schools, and correspondence on such plans, should invariably be addressed to the Secretary, Board of Education, Whitehall, London, S.W., and not to any officer of the Board by name.

Plans must, except in special circumstances, be submitted to the Board through the Governing Body by their recognised correspondent, unless that body has approved the direct submission of plans to the Board by an architect or by the Managers. In such cases the covering letter should refer to the direction or approval of the Governing Body, and failing this the Board may decline to consider the plans; in any case much delay and confusion is caused.

In cases where sufficient funds are not available for the immediate erection of the whole building, those portions not proposed to be carried out at once should be clearly indicated.

Duplicate copies of the block plan and of the plan of each floor must be sent for retention by the Board.

REQUIREMENTS.

(*All plans, whether for new buildings or for improvements to existing buildings, must be submitted in accordance with the requirements which follow; plans which do not fully comply with these requirements cannot be considered.*)

I. A BLOCK PLAN OF THE SITE, drawn in ink to a scale of 20 feet to an inch. This plan must indicate:—

(*a.*) The position of the School buildings.
(*b.*) Out-buildings.
(*c.*) Playground.
(*d.*) Drains (collateral and main), with their fall and depth below ground.
(*e.*) Entrances.
(*f.*) Boundary walls or fences, and their nature.
(*g.*) Roads.
(*h.*) The points of the compass.
(*i.*) The levels of the ground at the principal points.

N.B.—For approval of the site alone, the plan should show (*g*), (*h*), and (*i*).

II. A PLAN OF EACH FLOOR OF THE SCHOOL-ROOMS (AND TEACHER'S OR CARETAKER'S HOUSE, if any), drawn in ink to a scale of 8 feet to an inch. The internal fittings of the rooms (*fireplaces, groups of desks, &c.*) must be accurately

shown. The plan should also state whether the rooms are intended for boys, girls, or infants.

In cases of enlargement, a plan showing the buildings as they exist is needed.

III. SECTIONS, and at least four ELEVATIONS, also drawn in ink to a scale of 8 feet to an inch. The ceiling, the positions of window-heads in relation thereto, and the mode of ventilation must be shown.

N.B.—(*a.*) Pencil drawings cannot be received, but sketch plans or coloured tracings in ink on tracing cloth may be submitted while plans are in the preliminary stage of pencil, so that suggested alterations can be adopted without difficulty or expense. Such plans may be drawn to a scale of 16 ft. to 1 in. The Board's final approval will not in any case be given to preliminary plans, and the full plans described above will always be required.

(*b.*) Diagrams are of no value and cannot be accepted.

(*c.*) In the case of enlargements or alterations, the whole site and the existing building should be as accurately shown in every respect as the proposed changes, and in such a manner that any change of numbers can be ascertained.

(*d.*) All plans should be dated, the scales drawn on, and dimensions figured.

(*e.*) It is preferable that all plans should be submitted on linen tracing paper or other material which can be folded.

IV. A concise description of the buildings, and of the various rooms, with their dimensions and uses. The total number of scholars of each sex for whom accommodation is proposed to be provided must be stated.

V. In the case of alterations, adaptations, or additions the proposed accommodation must be clearly shown.

VI. A DRAFT SPECIFICATION.

VII. AN ESTIMATE of the total expenditure proposed.

Appendix C.

RULES FOR PLANNING AND FITTING UP SCHOOLS FOR BLIND OR DEAF CHILDREN.

THESE Rules should be read in connection with the General Rules laid down in the Rules for Planning and Fitting up Public Elementary Schools. Rules 3-10 apply only to Institutions in which children are boarded and lodged as well as taught.

Schools for the blind and the deaf should not be held in the same building.

1. Playgrounds.

Where no field or other larger space has been secured, the superficial area of the site should provide not less than 30 sq. ft. per child of open space exclusive of buildings. The playgrounds for boys and girls should be separate. There should be a large covered shed open on one side, provided with ample top light, which, under supervision, may be used by boys and girls together.

2. Class-rooms.

The area should be, as a rule, not less than 20 sq. ft., and the cubic contents should be not less than 240 cub. ft. per child, and no Class-room should be arranged to accommodate more than 20 children. The position should be on the ground floor, near the playground. Where boys and girls are taught in one room, the exits should be separate.

The light should be ample, and such as to suit the mode of teaching employed.

The children should, as a rule, be arranged in a semicircle round the teacher, and the light should be arranged so as to enable the teacher to see, in the case of the blind, every change of facial expression, and so that in the case of the deaf the teacher and scholars may observe closely the action of the lips.

In a Day School there should be a hall or wide corridor, and, if possible, a room in which manual instruction can be given; failing provision for this, in adjacent Schools. In Day Schools there should also be a room for the use of the teachers.

3. Day Rooms.

These should be of at least the same size as the class-rooms.

4. Dining-rooms.

These should be of sufficient size to seat each child comfortably, with space for the passage of waiters. There should be a minimum of 10 sq. ft. per child.

5. Dormitories.

The minimum width should be 18 ft., or 16 ft. in small dormitories with not more than twelve beds, the minimum area should be 50 sq. ft. per child, and the minimum cubic capacity 500 cub. ft. per child. A separate bed must be provided for each child, with sufficient space between the beds.

Cross ventilation should be provided where possible.

A dormitory should be supervised by means of a window in the bedroom of the officer in charge. In houses or homes having small bedrooms, the officer's bedroom should be closely adjoining on the same floor.

No boys over nine years of age should be lodged with girls, unless in a distinct wing approached by a separate staircase.

Boys under nine years of age may be lodged with girls, but must have separate sleeping rooms.

Each teacher should have a separate bedroom.

Adequate provision should be made for storing clothing and household materials, and each child should have a locker or box in which to keep his own property.

6. Sick-rooms.

These should be separate for each sex, and should consist of two rooms in each case, viz., one for the patients and the other for the nurse. An aspect S.E., S., or S.W. is to be preferred.

A detached building is also necessary for infectious cases, except in the neighbourhood of an hospital to which cases can be readily conveyed.

7. Baths and Lavatories.

These should be supplied with hot and cold water, and should be sufficient to enable each child to obtain a bath at least once a week in winter and twice in summer. Lavatory basins should be sufficient to enable each child to wash the hands, face, and upper portion of the body morning and evening. The water supply should be sufficient to admit of fresh water for each child. There should be provision in the bath-rooms and lavatories for a separate towel for each child.

8. Latrines.

For Day Use.—The provision of closets should be 10 per cent. on the number of boys, together with a urinal; and 15 per cent. on the number of girls.

For Night Use.—One or two closets should be provided adjoining the dormitories, but disconnected therefrom by a lobby having a current of air by windows on two sides.

9. Staircases and Corridors.

These must be fireproof.

10. Fire Escapes.

Where only one staircase exists, or where the dormitories are at some distance from the staircases, fire escapes should be provided.

Appendix D.

EDUCATION ACT, 1902.

2 Edw. 7. Cap. 42.

ARRANGEMENT OF SECTIONS.

PART IV.—GENERAL.

AN ACT TO MAKE FURTHER PROVISION WITH RESPECT TO EDUCATION IN ENGLAND AND WALES [18TH DECEMBER 1902].

BE it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

PART I.—LOCAL EDUCATION AUTHORITY.

Local education authorities.

1. For the purposes of this Act the council of every county and of every county borough shall be the local education authority:

Provided that the council of a borough with a population of over ten thousand, or of an urban district with a population of over twenty thousand, shall, as respects that borough or district, be the local education authority for the purpose of Part III. of this Act, and for that purpose, as respects that borough or district, the expression "local education authority" means the council of that borough or district.

PART II.—HIGHER EDUCATION.

Power to aid higher education.

2.—(1) The local education authority shall consider the educational needs of their area and take such steps as seem to them desirable, after consultation with the Board of Education, to supply or aid the supply of education other than elementary, and to promote the general co-ordination of all forms of education, and for that purpose shall apply all or so much as they deem necessary of the residue under section one of the Local Taxation (Customs and Excise) Act, 1890, and shall carry forward for the like purpose any balance thereof which may remain unexpended, and may spend such further sums as they think fit: Provided that the amount raised by the council of a county for the purpose in any year out of rates under this Act shall not exceed the amount which would be produced by a rate of twopence in the pound, or such higher rate as the county council, with the consent of the Local Government Board, may fix.

53 & 54 Vict. c. 60.

(2) A council, in exercising their powers under this part of this Act, shall have regard to any existing supply of efficient schools or colleges, and to any steps already taken for the purposes of higher education under the Technical Instruction Acts, 1889 and 1891.

52 & 53 Vict. c. 76.
54 & 55 Vict. c. 4.

Concurrent powers of smaller boroughs and urban districts.

3. The council of any non-county borough or urban district shall have power as well as the county council to spend such sums as they think fit for the purpose of supplying or aiding the supply of education other than elementary: Provided that the amount raised by the

council of a non-county borough or urban district for the purpose in any year out of rates under this Act shall not exceed the amount which would be produced by a rate of one penny in the pound.

4.—(1) A council, in the application of money under this part of this Act, shall not require that any particular form of religious instruction or worship or any religious catechism or formulary which is distinctive of any particular denomination shall or shall not be taught, used, or practised in any school, college, or hostel aided but not provided by the council, and no pupil shall, on the ground of religious belief, be excluded from or placed in an inferior position in any school, college, or hostel provided by the council, and no catechism or formulary distinctive of any particular religious denomination shall be taught in any school, college, or hostel so provided, except in cases where the council, at the request of parents of scholars, at such times and under such conditions as the council think desirable, allow any religious instruction to be given in the school, college, or hostel, otherwise than at the cost of the council: Provided that in the exercise of this power no unfair preference shall be shown to any religious denomination. Religious instruction.

(2) In a school or college receiving a grant from, or maintained by, a council under this part of this Act,

(*a*) A scholar attending as a day or evening scholar shall not be required, as a condition of being admitted into or remaining in the school or college, to attend or abstain from attending any Sunday school, place of religious worship, religious observance, or instruction in religious subjects in the school or college or elsewhere; and

(*b*) The times for religious worship or for any lesson on a religious subject shall be conveniently arranged for the purpose of allowing the withdrawal of any such scholar therefrom.

PART III.—ELEMENTARY EDUCATION.

5. The local education authority shall throughout their area have the powers and duties of a school board and school attendance committee under the Elementary Education Acts, 1870 to 1900, and any other Acts, including local Acts, and shall also be responsible for and have the control of all secular instruction in public elementary schools not provided by them, and school boards and school attendance committees shall be abolished. Powers and duties as to elementary education.

6.—(1) All public elementary schools provided by the local education authority shall, where the local education authority are the council of a county, have a body of managers consisting of a Management of Schools.

number of managers not exceeding four appointed by that council, together with a number not exceeding two appointed by the minor local authority.

Where the local education authority are the council of a borough or urban district they may, if they think fit, appoint for any school provided by them a body of managers consisting of such number of managers as they may determine.

(2) All public elementary schools not provided by the local education authority shall, in place of the existing managers, have a body of managers consisting of a number of foundation managers not exceeding four appointed as provided by this Act, together with a number of managers not exceeding two appointed—

(*a*) where the local education authority are the council of a county, one by that council and one by the minor local authority; and

(*b*) where the local education authority are the council of a borough or urban district, both by that authority.

(3) Notwithstanding anything in this section—

(*a*) Schools may be grouped under one body of managers in manner provided by this Act; and

(*b*) Where the local education authority consider that the circumstances of any school require a larger body of managers than that provided under this section, that authority may increase the total number of managers, so, however, that the number of each class of managers is proportionately increased.

Maintenance of Schools.

7.—(1) The local education authority shall maintain and keep efficient all public elementary schools within their area which are necessary, and have the control of all expenditure required for that purpose, other than expenditure for which, under this Act, provision is to be made by the managers; but, in the case of a school not provided by them, only so long as the following conditions and provisions are complied with:—

(*a*) The managers of the school shall carry out any directions of the local education authority as to the secular instruction to be given in the school, including any directions with respect to the number and educational qualifications of the teachers to be employed for such instruction, and for the dismissal of any teacher on educational grounds, and if the managers fail to carry out any such direction the local education authority shall, in addition to their other powers, have the power themselves to carry out

the direction in question as if they were the managers; but no direction given under this provision shall be such as to interfere with reasonable facilities for religious instruction during school hours;

(*b*) The local education authority shall have power to inspect the school;

(*c*) The consent of the local education authority shall be required to the appointment of teachers, but that consent shall not be withheld except on education grounds; and the consent of the authority shall also be required to the dismissal of a teacher unless the dismissal be on grounds connected with the giving of religious instruction in the school;

(*d*) The managers of the school shall provide the schoolhouse free of any charge, except for the teacher's dwelling-house (if any), to the local education authority for use as a public elementary school, and shall, out of funds provided by them, keep the schoolhouse in good repair, and make such alterations and improvements in the buildings as may be reasonably required by the local education authority: Provided that such damage as the local authority consider to be due to fair wear and tear in the use of any room in the schoolhouse for the purpose of a public elementary school shall be made good by the local education authority;

(*e*) The managers of the school shall, if the local education authority have no suitable accommodation in schools provided by them, allow that authority to use any room in the schoolhouse out of school hours free of charge for any educational purpose, but this obligation shall not extend to more than three days in the week.

(2) The managers of a school maintained but not provided by the local education authority, in respect of the use by them of the school furniture out of school hours, and the local education authority in respect of the use by them of any room in the schoolhouse out of school hours, shall be liable to make good any damage caused to the furniture or the room, as the case may be, by reason of that use (other than damage arising from fair wear and tear), and the managers shall take care that, after the use of a room in the schoolhouse by them, the room is left in a proper condition for school purposes.

(3) If any question arises under this section between the local education authority and the managers of a school not provided by the authority, that question shall be determined by the Board of Education.

(4) One of the conditions required to be fulfilled by an elementary school in order to obtain a parliamentary grant shall be that it is maintained under and complies with the provisions of this section.

(5) In public elementary schools maintained but not provided by the local education authority, assistant teachers and pupil teachers may be appointed, if it is thought fit, without reference to religious creed and denomination, and, in any case in which there are more candidates for the post of pupil teacher than there are places to be filled, the appointment shall be made by the local education authority, and they shall determine the respective qualifications of the candidates by examination or otherwise.

(6) Religious instruction given in a public elementary school not provided by the local education authority shall, as regards its character, be in accordance with the provisions (if any) of the trust deed relating thereto, and shall be under the control of the managers: Provided that nothing in this subsection shall affect any provision in a trust deed for reference to the bishop or superior ecclesiastical or other denominational authority so far as such provision gives to the bishop or authority the power of deciding whether the character of the religious instruction is or is not in accordance with the provisions of the trust deed.

(7) The managers of a school maintained but not provided by the local education authority shall have all powers of management required for the purpose of carrying out this Act, and shall (subject to the powers of the local education authority under this section) have the exclusive power of appointing and dismissing teachers.

Provision of new Schools.

8.—(1) Where the local education authority or any other persons propose to provide a new public elementary school, they shall give public notice of their intention to do so, and the managers of any existing school, or the local education authority (where they are not themselves the persons proposing to provide the school), or any ten ratepayers in the area for which it is proposed to provide the school, may, within three months after the notice is given, appeal to the Board of Education on the ground that the proposed school is not required, or that a school provided by the local education authority, or not so provided, as the case may be, is better suited to meet the wants of the district than the school proposed to be provided, and any school built in contravention of the decision of the Board of Education on such appeal shall be treated as unnecessary.

(2) If, in the opinion of the Board of Education, any enlargement of a public elementary school is such as to amount to the provision of a new school, that enlargement shall be so treated for the purposes of this section.

(3) Any transfer of a public elementary school to or from a local education authority shall for the purposes of this section be treated as the provision of a new school.

9. The Board of Education shall, without unnecessary delay, determine, in case of dispute, whether a school is necessary or not, and, in so determining, and also in deciding on any appeal as to the provision of a new school, shall have regard to the interest of secular instruction, to the wishes of parents as to the education of their children, and to the economy of the rates; but a school for the time being recognised as a public elementary school shall not be considered unnecessary in which the number of scholars in average attendance, as computed by the Board of Education, is not less than thirty. Necessity of Schools.

10.—(1) In lieu of the grants under the Voluntary Schools Act, 1897, and under section ninety-seven of the Elementary Education Act, 1870, as amended by the Elementary Education Act, 1897, there shall be annually paid to every local education authority, out of moneys provided by Parliament— Aid grant. 60 & 61 Vict. c. 5. 33 & 34 Vict. c. 75. 60 & 61 Vict. c. 16.

(a) a sum equal to four shillings per scholar; and

(b) an additional sum of three halfpence per scholar for every complete twopence per scholar by which the amount which would be produced by a penny rate on the area of the authority falls short of ten shillings a scholar: Provided that, in estimating the produce of a penny rate in the area of a local education authority not being a county borough, the rate shall be calculated upon the county rate basis, which, in cases where part only of a parish is situated in the area of the local education authority, shall be apportioned in such manner as the Board of Education think just.

But if in any year the total amount of parliamentary grants payable to a local education authority would make the amount payable out of other sources by that authority on account of their expenses under this part of this Act less than the amount which would be produced by a rate of threepence in the pound, the parliamentary grant shall be decreased, and the amount payable out of other sources shall be increased by a sum equal in each case to half the difference.

(2) For the purposes of this section the number of scholars shall be taken to be the number of scholars in average attendance, as computed by the Board of Education, in public elementary schools maintained by the authority.

11.—(1) The foundation managers of a school shall be managers appointed under the provisions of the trust deed of the school, but if Foundation managers.

it is shown to the satisfaction of the Board of Education that the provisions of the trust deed as to the appointment of managers are in any respect inconsistent with the provisions of this Act, or insufficient or inapplicable for the purpose, or that there is no such trust deed available, the Board of Education shall make an order under this section for the purpose of meeting the case.

(2) Any such order may be made on the application of the existing owners, trustees, or managers of the school, made within a period of three months after the passing of this Act, and after that period on the application of the local education authority or any other person interested in the management of the school, and any such order, where it modifies the trust deed, shall have effect as part of the trust deed, and where there is no trust deed shall have effect as if it were contained in a trust deed.

(3) Notice of any such application, together with a copy of the draft final order proposed to be made thereon, shall be given by the Board of Education to the local education authority and the existing owners, trustees, and managers, and any other persons who appear to the Board of Education to be interested, and the final order shall not be made until six weeks after notice has been so given.

(4) In making an order under this section with regard to any school, the Board of Education shall have regard to the ownership of the school building, and to the principles on which the education given in the school has been conducted in the past.

(5) The Board of Education may, if they think that the circumstances of the case require it, make any interim order on any application under this section to have temporary effect until the final order is made.

(6) The body of managers appointed under this Act for a public elementary school not provided by the local education authority shall be the managers of that school both for the purposes of the Elementary Education Acts, 1870 to 1900, and this Act, and, so far as respects the management of the school as a public elementary school, for the purpose of the trust deed.

(7) Where the receipt by a school, or the trustees or managers of a school, of any endowment or other benefit is, at the time of the passing of this Act, dependent on any qualification of the managers, the qualification of the foundation managers only shall, in case of question, be regarded.

(8) The Board of Education may, on the application of the managers of the school, the local education authority, or any person appearing to them to be interested in the school, revoke, vary, or amend any order made under this section by an order made in a similar manner; but before making any such order the draft thereof

shall, as soon as may be, be laid before each House of Parliament, and, if within thirty days, being days on which Parliament has sat, after the draft has been so laid before Parliament, either House resolves that the draft, or any part thereof, should not be proceeded with, no further proceedings shall be taken thereon, without prejudice to the making of any new draft order.

12.—(1) The local education authority may group under one body of managers any public elementary schools provided by them, and may also, with the consent of the managers of the schools, group under one body of managers any such schools not so provided. Grouping of schools under one management.

(2) The body of managers of grouped schools shall consist of such number and be appointed in such manner and proportion as, in the case of schools provided by the local education authority, may be determined by that authority, and in the case of schools not so provided, may be agreed upon between the bodies of managers of the schools concerned and the local education authority, or in default of agreement may be determined by the Board of Education.

(3) Where the local education authority are the council of a county, they shall make provision for the due representation of minor local authorities on the bodies of managers of schools grouped under their direction.

(4) Any arrangement for grouping schools not provided by the local education authority shall, unless previously determined by consent of the parties concerned, remain in force for a period of three years.

13.—(1) Nothing in this Act shall affect any endowment, or the discretion of any trustees in respect thereof: Provided that, where under the trusts or other provisions affecting any endowment the income thereof must be applied in whole or in part for those purposes of a public elementary school for which provision is to be made by the local education authority, the whole of the income or the part thereof, as the case may be, shall be paid to that authority, and, in case part only of such income must be so applied and there is no provision under the said trusts or provisions for determining the amount which represents that part, that amount shall be determined, in case of difference between the parties concerned, by the Board of Education; but if a public inquiry is demanded by the local education authority, the decision of the Board of Education shall not be given until after such an inquiry, of which ten days' previous notice shall be given to the local education authority and to the minor local authority and to the trustees, shall have been first held by the Board of Education at the cost of the local education authority. Endowments.

(2) Any money arising from an endowment, and paid to a county council for those purposes of a public elementary school for which provision is to be made by the council, shall be credited by the council

in aid of the rate levied for the purposes of this part of this Act in the parish or parishes which in the opinion of the council are served by the school for the purposes of which the sum is paid, or, if the council so direct, shall be paid to the overseers of the parish or parishes in the proportions directed by the council, and applied by the overseers in aid of the poor rate levied in the parish.

Apportionment of school fees.

14. Where before the passing of this Act fees have been charged in any public elementary school not provided by the local education authority, that authority shall, while they continue to allow fees to be charged in respect of that school, pay such proportion of those fees as may be agreed upon, or, in default of agreement, determined by the Board of Education, to the managers.

Schools attached to institutions.

15. The local education authority may maintain as a public elementary school under the provisions of this Act, but shall not be required so to maintain, any Marine school, or any school which is part of, or is held in the premises of, any institution in which children are boarded, but their refusal to maintain such a school shall not render the school incapable of receiving a parliamentary grant, nor shall the school, if not so maintained, be subject to the provisions of this Act as to the appointment of managers, or as to control by the local education authority.

Power to enforce duties under Elementary Education Acts. 33 & 34 Vict. c. 75.

16. If the local education authority fail to fulfil any of their duties under the Elementary Education Acts, 1870 to 1900, or this Act, or fail to provide such additional public school accommodation within the meaning of the Elementary Education Act, 1870, as is, in the opinion of the Board of Education, necessary in any part of their area, the Board of Education may, after holding a public inquiry, make such order as they think necessary or proper for the purpose of compelling the authority to fulfil their duty, and any such order may be enforced by mandamus.

Part IV.—General.

Education committees.

17.—(1) Any council having powers under this Act shall establish an education committee or education committees, constituted in accordance with a scheme made by the council and approved by the Board of Education: Provided that if a Council having powers under Part II. only of this Act determine that an education committee is unnecessary in their case, it shall not be obligatory on them to establish such a committee.

(2) All matters relating to the exercise by the council of their powers under this Act, except the power of raising a rate or borrowing money, shall stand referred to the education committee, and the council, before exercising any such powers, shall, unless in their opinion

the matter is urgent, receive and consider the report of the education committee with respect to the matter in question. The council may also delegate to the education committee, with or without any restrictions or conditions as they think fit, any of their powers under this Act, except the power of raising a rate or borrowing money.

(3) Every such scheme shall provide—

(*a*) for the appointment by the council of at least a majority of the committee, and the persons so appointed shall be persons who are members of the council, unless, in the case of a county, the council shall otherwise determine ;

(*b*) for the appointment by the council, on the nomination or recommendation, where it appears desirable, of other bodies (including associations of voluntary schools), of persons of experience in education, and of persons acquainted with the needs of the various kinds of schools in the area for which the council acts ;

(*c*) for the inclusion of women as well as men among the members of the committee ;

(*d*) for the appointment, if desirable, of members of school boards existing at the time of the passing of this Act as members of the first committee.

(4) Any person shall be disqualified for being a member of an education committee, who, by reason of holding an office or place of profit, or having any share or interest in a contract or employment, is disqualified for being a member of the council appointing the education committee, but no such disqualification shall apply to a person by reason only of his holding office in a school or college aided, provided, or maintained by the council.

(5) Any such scheme may, for all or any purposes of this Act, provide for the constitution of a separate education committee for any area within a county, or for a joint education committee for any area formed by a combination of counties, boroughs, or urban districts, or of parts thereof. In the case of any such joint committee, it shall suffice that a majority of the members are appointed by the councils of any of the counties, boroughs, or districts out of which or parts of which the area is formed.

(6) Before approving a scheme, the Board of Education shall take such measures as may appear expedient for the purpose of giving publicity to the provisions of the proposed scheme, and, before approving any scheme which provides for the appointment of more than one education committee, shall satisfy themselves that due regard is paid to the importance of the general co-ordination of all forms of education.

(7) If a scheme under this section has not been made by a council

and approved by the Board of Education within twelve months after the passing of this Act, that Board may, subject to the provisions of this Act, make a Provisional Order for the purposes for which a scheme might have been made.

(8) Any scheme for establishing an education committee of the council of any county or county borough in Wales or of the county of Monmouth or county borough of Newport shall provide that the county governing body constituted under the Welsh Intermediate Education Act, 1889, for any such county or county borough shall cease to exist, and shall make such provision as appears necessary or expedient for the transfer of the powers, duties, property, and liabilities of any such body to the local education authority under this Act, and for making the provisions of this section applicable to the exercise by the local education authority of the powers so transferred.

52 & 53 Vict. c. 40.

Expenses.

18.—(1) The expenses of a council under this Act shall, so far as not otherwise provided for, be paid, in the case of the council of a county out of the county fund, and in the case of the council of a borough out of the borough fund or rate, or, if no borough rate is levied, out of a separate rate to be made, assessed, and levied in like manner as the borough rate, and in the case of the council of an urban district other than a borough in manner provided by section thirty-three of the Elementary Education Act, 1876, as respects the expenses mentioned in that section; Provided that—

39 & 40 Vict. c. 79.

(*a*) the county council may, if they think fit (after giving reasonable notice to the overseers of the parish or parishes concerned), charge any expenses incurred by them under this Act with respect to education other than elementary on any parish or parishes which, in the opinion of the council, are served by the school or college in connexion with which the expenses have been incurred; and

(*b*) the county council shall not raise any sum on account of their expenses under Part III. of this Act within any borough or urban district the council of which is the local education authority for the purposes of that Part; and

(*c*) the county council shall charge such portion as they think fit, not being less than one-half or more than three-fourths, of any expenses incurred by them in respect of capital expenditure or rent on account of the provision or improvement of any public elementary school on the parish or parishes which, in the opinion of the council, are served by the school; and

(*d*) the county council shall raise such portion as they think fit, not being less than one-half or more than three-fourths,

of any expenses incurred to meet the liabilities on account of loans or rent of any school board transferred to them, exclusively within the area which formed the school district in respect of which the liability was incurred, so far as it is within their area.

(2) All receipts in respect of any school maintained by a local education authority, including any parliamentary grant, but excluding sums specially applicable for purposes for which provision is to be made by the managers, shall be paid to that authority.

(3) Separate accounts shall be kept by the council of a borough of their receipts and expenditure under this Act, and those accounts shall be made up and audited in like manner and subject to the same provisions as the accounts of a county council, and the enactments relating to the audit of those accounts and to all matters incidental thereto, and consequential thereon, including the penal provisions, shall apply in lieu of the provisions of the Municipal Corporations Act, 1882, relating to accounts and audit. 45 & 46 Vict. c. 50.

(4) Where under any local Act the expenses incurred in any borough for the purposes of the Elementary Education Acts, 1870 to 1900, are payable out of some fund or rate other than the borough fund or rate, the expenses of the council of that borough under this Act shall be payable out of that fund or rate instead of out of the borough fund or rate.

(5) Where any receipts or payments of money under this Act are entrusted by the local education authority to any education committee established under this Act, or to the managers of any public elementary school, the accounts of those receipts and payments shall be accounts of the local education authority, but the auditor of those accounts shall have the same powers with respect to managers as he would have if the managers were officers of the local education authority.

Borrowing.

19.—(1) A council may borrow for the purposes of the Elementary Education Acts, 1870 to 1900, or this Act, in the case of a county council as for the purposes of the Local Government Act, 1888, and in the case of the council of a county borough, borough, or urban district as for the purposes of the Public Health Acts, but the money borrowed by a county borough, borough, or urban district council shall be borrowed on the security of the fund or rate out of which the expenses of the council under this Act are payable. 51 & 52 Vict. c. 41.

(2) Money borrowed under this Act shall not be reckoned as part of the total debt of a county for the purposes of section sixty-nine of the Local Government Act, 1888, or as part of the debt of a county borough, borough, or urban district for the purpose of the limitation on

borrowing under subsections two and three of section two hundred and thirty-four of the Public Health Act, 1875.

38 & 39 Vict. c. 55.

Arrangements between councils.

20. An authority having powers under this Act—

(*a*) may make arrangements with the council of any county, borough, district, or parish, whether a local education authority or not, for the exercise by the council, on such terms and subject to such conditions as may be agreed on, of any powers of the authority in respect of the management of any school or college within the area of the council; and

(*b*) if the authority is the council of a non-county borough or urban district may, at any time after the passing of this Act, by agreement with the council of the county, and with the approval of the Board of Education, relinquish in favour of the council of the county any of their powers and duties under this Act, and in that case the powers and duties of the authority so relinquished shall cease, and the area of the authority, if the powers and duties relinquished include powers as to elementary education, shall, as respects those powers, be part of the area of the county council.

Provisional Orders and schemes. 38 & 39 Vict. c. 55.

21.—(1) Sections two hundred and ninety-seven and two hundred and ninety-eight of the Public Health Act, 1875 (which relate to Provisional Orders), shall apply to any Provisional Order made under this Act as if it were made under that Act, but references to a local authority shall be construed as references to the authority to whom the Order relates, and references to the Local Government Board shall be construed as references to the Board of Education.

(2) Any scheme or Provisional Order under this Act may contain such incidental or consequential provisions as may appear necessary or expedient.

(3) A scheme under this Act when approved shall have effect as if enacted in this Act, and any such scheme, or any Provisional Order made for the purposes of such a scheme, may be revoked or altered by a scheme made in like manner and having the same effect as an original scheme.

Provision as to elementary and higher education powers respectively.

22.—(1) In this Act and in the Elementary Education Acts the expression "elementary school" shall not include any school carried on as an evening school under the regulations of the Board of Education.

(2) The power to provide instruction under the Elementary Education Acts, 1870 to 1900, shall, except where those Acts expressly provide to the contrary, be limited to the provision in a public elementary school of instruction given under the regulations

of the Board of Education to scholars who, at the close of the school year, will not be more than sixteen years of age: Provided that the local education authority may, with the consent of the Board of Education, extend those limits in the case of any such school if no suitable higher education is available within a reasonable distance of the school.

(3) The power to supply or aid the supply of education other than elementary includes a power to train teachers, and to supply or aid the supply of any education except where that education is given at a public elementary school.

23.—(1) The powers of a council under this Act shall include the provision of vehicles or the payment of reasonable travelling expenses for teachers or children attending school or college whenever the council shall consider such provision or payment required by the circumstances of their area or of any part thereof. Miscellaneous provisions.

(2) The power of a council to supply or aid the supply of education, other than elementary, shall include power to make provision for the purpose outside their area in cases where they consider it expedient to do so in the interests of their area, and shall include power to provide or assist in providing scholarships for, and to pay or assist in paying the fees of, students ordinarily resident in the area of the council at schools or colleges or hostels within or without that area.

(3) The county councillors elected for an electoral division consisting wholly of a borough or urban district whose council are a local education authority for the purpose of Part III. of this Act, or of some part of such a borough or district, shall not vote in respect of any question arising before the county council which relates only to matters under Part III. of this Act.

(4) The amount which would be produced by any rate in the pound shall be estimated for the purposes of this Act in accordance with regulations made by the Local Government Board.

(5) The Mortmain and Charitable Uses Act, 1888, and so much of the Mortmain and Charitable Uses Act, 1891, as requires that land assured by will shall be sold within one year from the death of the testator, shall not apply to any assurance, within the meaning of the said Act of 1888, of land for the purpose of a school house for an elementary school. 51 & 52 Vict. c. 42. 54 & 55 Vict. c. 73.

(6) A woman is not disqualified, either by sex or marriage, for being on any body of managers or education committee under this Act.

(7) Teachers in a school maintained but not provided by the local education authority shall be in the same position as respects

disqualification for office as members of the authority as teachers in a school provided by the authority.

(8) Population for the purposes of this Act shall be calculated according to the census of nineteen hundred and one.

51 & 52 Vict. c. 41. (9) Subsections one and five of section eighty-seven of the Local Government Act, 1888 (which relate to local inquiries), shall apply with respect to any order, consent, sanction, or approval which the Local Government Board are authorised to make or give under this Act.

33 & 34 Vict. c. 75. (10) The Board of Education may, if they think fit, hold a public inquiry for the purpose of the exercise of any of their powers or the performance of any of their duties under this Act, and section seventy-three of the Elementary Education Act, 1870, shall apply to any public inquiry so held or held under any other provision of this Act.

Interpretation.

24.—(1) Unless the context otherwise requires, any expression to which a special meaning is attached in the Elementary Education Acts, 1870 to 1900, shall have the same meaning in this Act.

(2) In this Act the expression "minor local authority" means, as respects any school, the council of any borough or urban district, or the parish council or (where there is no parish council) the parish meeting of any parish which appears to the county council to be served by the school. Where the school appears to the county council to serve the area of more than one minor local authority the county council shall make such provision as they think proper for joint appointment of managers by the authorities concerned.

51 & 52 Vict. c. 41. (3) In this Act the expressions "powers," "duties," "property," and "liabilities" shall, unless the context otherwise requires, have the same meanings as in the Local Government Act, 1888.

(4) In this Act the expression "college" includes any educational institution, whether residential or not.

(5) In this Act, unless the context otherwise requires, the expression "trust deed" includes any instrument regulating the trusts or management of a school or college.

Provisions as to proceedings, transfer, &c., application of enactments and repeal.

25.—(1) The provisions set out in the First and Second Schedules to this Act relating to education committees and managers, and to the transfer of property and officers, and adjustment, shall have effect for the purpose of carrying the provisions of this Act into effect.

(2) In the application of the Elementary Education Acts, 1870 to

1900, and other provisions referred to in that schedule, the modifications specified in the Third Schedule to this Act shall have effect.

(3) The enactments mentioned in the Fourth Schedule to this Act shall be repealed to the extent specified in the third column of that schedule.

26. For the purposes of this Act the Council of the Isles of Scilly shall be the local education authority for the Scilly Islands, and the expenses of the council under this Act shall be general expenses of the Council. Application of Act to Scilly Islands.

27.—(1) This Act shall not extend to Scotland or Ireland, or, except as expressly provided, to London. Extent, commencement, and short title.

(2) This Act shall, except as expressly provided, come into operation on the appointed day, and the appointed day shall be the twenty-sixth day of March nineteen hundred and three, or such other day, not being more than eighteen months later, as the Board of Education may appoint, and different days may be appointed for different purposes and for different provisions of this Act, and for different councils.

(3) The period during which local authorities may, under the Education Act, 1901, as renewed by the Education Act, 1901 (Renewal) Act, 1902, empower school boards to carry on the work of the schools and classes to which those Acts relate shall be extended to the appointed day, and in the case of London to the twenty-sixth day of March nineteen hundred and four. 1 Edw. 7, c. 11. 2 Edw. 7, c. 19.

(4) This Act may be cited as the Education Act, 1902, and the Elementary Education Acts, 1870 to 1900, and this Act may be cited as the Education Acts, 1870 to 1902.

SCHEDULES.

Section 25.

FIRST SCHEDULE.

Provision as to Education Committees and Managers.

A.—*Education Committees.*

(1) The council by whom an education committee is established may make regulations as to the quorum, proceedings, and place of meeting of that committee, but subject to any such regulations, the quorum, proceedings, and place of meeting of the committee shall be such as the committee determine.

(2) The chairman of the education committee at any meeting of the committee shall, in case of an equal division of votes, have a second or casting vote.

(3) The proceedings of an education committee shall not be invalidated by any vacancy among its members or by any defect in the election, appointment, or qualification of any members thereof.

(4) Minutes of the proceedings of an education committee shall be kept in a book provided for that purpose, and a minute of those proceedings, signed at the same or next ensuing meeting by a person describing himself as, or appearing to be, chairman of the meeting of the committee at which the minute is signed, shall be received in evidence without further proof.

(5) Until the contrary is proved, an education committee shall be deemed to have been duly constituted and to have power to deal with any matters referred to in its minutes.

(6) An education committee may, subject to any directions of the council, appoint such and so many sub-committees, consisting either wholly or partly of members of the committee, as the committee thinks fit.

B.—*Managers.*

(1) A body of managers may choose their chairman, except in cases where there is an ex-officio chairman, and regulate their quorum and proceedings in such manner as they think fit, subject, in the case of the managers of a school provided by the local education authority, to any directions of that authority.

Provided that the quorum shall not be less than three, or one-third of the whole number of managers, whichever is the greater.

(2) Every question at a meeting of a body of managers shall be determined by a majority of the votes of the managers present and voting on the question, and in case of an equal division of votes the chairman of the meeting shall have a second or casting vote.

(3) The proceedings of a body of managers shall not be invalidated by any vacancy in their number, or by any defect in the election, appointment, or qualification of any manager.

(4) The body of managers of a school provided by the local education authority shall deal with such matters relating to the management of the school, and subject to such conditions and restrictions, as the local education authority determine.

(5) A manager of a school not provided by the local education authority, appointed by that authority or by the minor local authority, shall be removable by the authority by whom he is appointed, and any such manager may resign his office.

(6) The body of managers shall hold a meeting at least once in every three months.

(7) Any two managers may convene a meeting of the body of managers.

(8) The minutes of the proceedings of every body of managers shall be kept in a book provided for that purpose.

(9) A minute of the proceedings of a body of managers, signed at the same or the next ensuing meeting by a person describing himself as, or appearing to be, chairman of the meeting at which the minute is signed, shall be received in evidence without further proof.

(10) The minutes of a body of managers shall be open to inspection by the local education authority.

(11) Until the contrary is proved, a body of managers shall be deemed to be duly constituted and to have power to deal with the matters referred to in their minutes.

SECOND SCHEDULE. Section 25.

Provisions as to Transfer of Property and Officers, and Adjustment.

(1) The property, powers, rights, and liabilities (including any property, powers, rights, and liabilities vested, conferred, or arising under any local Act or any trust deed) of any school board or school attendance committee existing at the appointed day shall be transferred to the council exercising the powers of the school board.

(2) Where, under the provisions of this Act, any council relinquishes its powers and duties in favour of a county council, any property or rights acquired and any liabilities incurred, for the purpose of the performance of the powers and duties relinquished, including any property or rights vested or arising, or any liabilities incurred, under any local Act or trust deed, shall be transferred to the county council.

(3) Any loans transferred to a council under this Act shall, for the purpose of the limitation on the powers of the council to borrow, be treated as money borrowed under this Act.

52 & 53 Vict. c. 76. 54 & 55 Vict. c. 4.

(4) Any liability of an urban district council incurred under the Technical Instruction Acts, 1889 and 1891, and charged on any fund or rate, shall, by virtue of this Act, become charged on the fund or rate out of which the expenses of the council under this Act are payable, instead of on the first-mentioned fund or rate.

53 & 54 Vict. c. 60.

(5) Section two of this Act shall apply to any balance of the residue under section one of the Local Taxation (Customs and Excise) Act, 1890, remaining unexpended and unappropriated by any council at the appointed day.

51 & 52 Vict. c. 41. 56 & 57 Vict. c. 73.

(6) Where the liabilities of a school board transferred to the local education authority under this Act comprise a liability on account of money advanced by that authority to the school board, the Local Government Board may make such orders as they think fit for providing for the repayment of any debts incurred by the authority for the purposes of those advances within a period fixed by the order, and, in case the money advanced to the school board has been money standing to the credit of any sinking fund or redemption fund or capital money applied under the Local Government Acts, 1888 and 1894, or either of them, for the repayment to the proper fund or account of the amount so advanced.

Any order of the Local Government Board made under this provision shall have effect as if enacted in this Act.

56 & 57 Vict. c. 42. 62 & 63 Vict. c. 32.

(7) Where a district council ceases by reason of this Act to be a school authority within the meaning of the Elementary Education (Blind and Deaf Children) Act, 1893, or the Elementary Education (Defective and Epileptic Children) Act, 1899, any property or rights acquired and any liabilities incurred under those Acts shall be transferred to the county council, and, notwithstanding anything in this Act, the county council may raise any expenses incurred by them to meet any liability of a school authority under those Acts (whether a district council or not), and transferred to the county council, off the whole of their area, or off any parish or parishes which in the opinion of the council are served by the school in respect of which the liability has been incurred.

(8) Sections eighty-five to eighty-eight of the Local Government Act, 1894 (which contain transitory provisions), shall apply with respect to any transfer mentioned in this schedule, subject as follows:— 56 & 57 Vict. c. 73.

(a) References to "the appointed day" and to "the passing of this Act" shall be construed, as respects a case of relinquishment of powers and duties, as references to the date on which the relinquishment takes effect; and

(b) the powers and duties of a school board or school attendance committee which is abolished, or a council which ceases under the provisions of this Act to exercise powers and duties, shall be deemed to be powers and duties transferred under this Act; and

(c) subsections four and five of section eighty-five shall not apply.

(9) The disqualification of any persons who are, at the time of the passing of this Act, members of any council, and who will become disqualified for office in consequence of this Act, shall not, if the council so resolve, take effect until a day fixed by the resolution, not being later than the next ordinary day of retirement of councillors in the case of a county council, the next ordinary day of election of councillors in the case of the council of a borough, and the fifteenth day of April in the year nineteen hundred and four in the case of an urban district council.

(10) No election of members of a school board shall be held after the passing of this Act, and the term of office of members of any school board holding office at the passing of this Act, or appointed to fill casual vacancies after that date, shall continue to the appointed day, and the Board of Education may make orders with respect to any matter which it appears to them necessary or expedient to deal with for the purpose of carrying this provision into effect, and any order so made shall operate as if enacted in this Act.

(11) Where required for the purpose of bringing the accounts of a school to a close before the end of the financial year of the school, or for the purpose of meeting any change consequent on this Act, the Board of Education may calculate any parliamentary grant in respect of any month or other period less than a year, and may pay any parliamentary grant which has accrued before the appointed day at such times and in such manner as they think fit.

(12) Any parliamentary grant payable to a public elementary school not provided by a school board in respect of a period before the appointed day shall be paid to the persons who were managers of 60 & 61 Vict. c. 5.

the school immediately before that day, and shall be applied by them in payment of the outstanding liabilities on account of the school, and so far as not required for that purpose shall be paid to the persons who are managers of the school for the purposes of this Act and shall be applied by them for the purposes for which provision is to be made under this Act by those managers, or for the benefit of any general fund applicable for those purposes; Provided that the Board of Education may, if they think fit, pay any share of the aid grant under the Voluntary Schools Act, 1897, allotted to an association of voluntary schools, to the governing body of that association, if such governing body satisfy the Board of Education that proper arrangements have been made for the application of any sum so paid.

(13) Any school which has been provided by a school board or is deemed to have been so provided shall be treated for the purposes of the Elementary Education Acts, 1870 to 1900, and this Act, as a school which has been provided by the local education authority, or which is deemed to have been so provided, as the case may be.

(14) The local education authority shall be entitled to use for the purposes of the school any school furniture and apparatus belonging to the trustees or managers of any public elementary school not provided by a school board, and in use for the purposes of the school before the appointed day.

(15) During the period between the passing of this Act and the appointed day, the managers of any public elementary school, whether provided by a school board or not, and any school attendance committee, shall furnish to the council, which will on the appointed day become the local education authority, such information as that council may reasonably require.

(16) The officers of any authority whose property, rights, and liabilities are transferred under this Act to any council shall be transferred to and become the officers of that council, but that council may abolish the office of any such officer whose office they deem unnecessary.

(17) Every officer so transferred shall hold his office by the same tenure and on the same terms and conditions as before the transfer, and while performing the same duties shall receive not less salary or remuneration than theretofore, but if any such officer is required to perform duties which are not analogous to or which are an unreasonable addition to those which he is required to perform at the date of the transfer, he may relinquish his office, and any officer who so relinquishes his office, or whose office is abolished, shall be entitled to compensation under this Act.

(18) A council may, if they think fit, take into account continuous service under any school boards or school attendance committees in order to calculate the total period of service of any officer entitled to compensation under this Act.

(19) If an officer of any authority to which the Poor Law Officers' Superannuation Act, 1896, applies is under this Act transferred to any council, and has made the annual contributions required to be made under that Act, the provisions of that Act shall apply, subject to such modifications as the Local Government Board may by order direct for the purpose of making that Act applicable to the case. 59 & 60 Vict. c. 50.

(20) Any local education authority who have established any pension scheme, or scheme for the superannuation of their officers, may admit to the benefits of that scheme any officers transferred under this Act on such terms and conditions as they think fit.

(21) Section one hundred and twenty of the Local Government Act, 1888, which relates to compensation to existing officers, shall apply as respects officers transferred under this Act, and also (with the necessary modifications) to any other officers who, by virtue of this Act or anything done in pursuance or in consequence of this Act, suffer direct pecuniary loss by abolition of office or by diminution or loss of fees or salary, in like manner as it applies to officers transferred under this Act, subject as follows:— 51 & 52 Vict. c. 41.

(*a*) any reference in that section to the county council shall include a reference to a borough or urban district council; and

(*b*) references in that section to "the passing of this Act" shall be construed, as respects a case of relinquishment of powers and duties, as references to the date on which the relinquishment takes effect; and

(*c*) any reference to powers transferred shall be construed as a reference to property transferred; and

(*d*) any expenses shall be paid out of the fund or rate out of which the expenses of a council under this Act are paid, and, if any compensation is payable otherwise than by way of an annual sum, the payment of that compensation shall be a purpose for which a council may borrow for the purposes of this Act.

(22) Section sixty-eight of the Local Government Act, 1894 (which relates to the adjustment of property and liabilities), shall apply with respect to any adjustment required for the purposes of this Act. 56 & 57 Vict. c. 73.

Section 25.

THIRD SCHEDULE.

Modification of Acts, &c.

39 & 40 Vict. c. 79. 53 & 54 Vict. c. 22.

(1) References to school boards and school districts shall be construed as references to local education authorities and the areas for which they act, except as respects transactions before the appointed day, and except that in paragraph (2) of section nineteen of the Elementary Education Act, 1876, and in subsection (1) of section two of the Education Code (1890) Act, 1890, references to a school district shall, as respects the area of a local education authority being the council of a county, be construed as references to a parish.

(2) References to the school fund or local rate shall be construed as references to the fund or rate out of which the expenses of the local education authority are payable.

(3) In section thirty-eight of the Elementary Education Act, 1876, references to members of a school board shall be construed as references to members of the education committee, or of any sub-committee appointed by that committee for school attendance purposes.

(4) The power of making byelaws shall (where the local education authority is a county council) include a power of making different byelaws for different parts of the area of the authority.

54 & 55 Vict. c. 56.

(5) The following provision shall have effect in lieu of section five of the Elementary Education Act, 1891:

"The duty of a local education authority under the Education Acts, 1870 to 1902, to provide a sufficient amount of public school accommodation shall include the duty to provide a sufficient amount of public school accommodation without payment of fees in every part of their area."

33 & 34 Vict. c. 75.

(6) The words "in the opinion of the Board of Education" shall be substituted for the words "in their opinion" in the first paragraph of section eighteen of the Elementary Education Act, 1870.

(7) Section ninety-nine of the Elementary Education Act, 1870, shall apply to the fulfilment of any conditions, the performance of any duties, and the exercise of any powers under this Act, as it applies to the fulfilment of conditions required in pursuance of that Act to be fulfilled in order to obtain a parliamentary grant.

36 & 37 Vict. c. 86. 56 & 57 Vict. c. 42.

(8) A reference to the provisions of this Act as to borrowing shall be substituted in section fifteen of the Elementary Education Act, 1876, for the reference to section ten of the Elementary Education Act, 1873, and a reference to the Local Government Board shall be substituted for the second reference in that section to the Education

Department, and also for the reference to the Education Department in section five of the Elementary Education (Blind and Deaf Children) Act, 1893.

(9) A reference to the provisions of this Act relating to the enforcement of the performance of the local education authority's duties by mandamus shall be substituted in section two of the Elementary Education Act, 1880, for the reference to section twenty-seven of the Elementary Education Act, 1876.

43 & 44 Vict. c. 23.
39 & 40 Vict. c. 79.

(10) The substitutions for board schools, school districts, school fund, and local rate made by this schedule shall, unless the context otherwise requires, be made in any enactment referring to or applying the Elementary Education Acts, 1870 to 1900, or any of them, so far as the reference or application extends.

(11) References in any enactment or in any provision of a scheme made under the Charitable Trusts Acts, 1853 to 1894, or the Endowed Schools Acts, 1869 to 1889, or the Elementary Education Acts, 1870 to 1900, to any provisions of the Technical Instruction Acts, 1889 and 1891, or either of those Acts, shall, unless the context otherwise requires, be construed as references to the provisions of Part II. of this Act, and the provisions of this Act shall apply with respect to any school, college, or hostel established, and to any obligation incurred, under the Technical Instruction Acts, 1889 and 1891, as if the school, college, or hostel had been established or the obligation incurred under Part II. of this Act.

52 & 53 Vict. c. 76.
54 & 55 Vict. c. 4.

(12) The Local Government Board may, after consultation with the Board of Education, by order make such adaptations in the provisions of any local Act (including any Act to confirm a Provisional Order and any scheme under the Municipal Corporations Act, 1882, as amended by any subsequent Act) as may seem to them to be necessary to make those provisions conform with the provisions of this Act, and may also in like manner, on the application of any council who have power as to education under this Act and have also powers as to education under any local Act, make such modifications in the local Act as will enable the powers under that Act to be exercised as if they were powers under this Act.

45 & 46 Vict. c. 50.

Any order made under this provision shall operate as if enacted in this Act.

FOURTH SCHEDULE.

Enactments Repealed.

Part I.

Session and Chapter.	Short Title.	Extent of Repeal.
52 & 53 Vict. c. 76.	The Technical Instruction Act, 1889.	The whole Act.
53 & 54 Vict. c. 60.	The Local Taxation (Customs and Excise) Act, 1890.	In section one, subsections two and three.
54 & 55 Vict. c. 4.	The Technical Instruction Act, 1891.	The whole Act.

Part II.

Session and Chapter.	Short Title.	Extent of Repeal.
33 & 34 Vict. c. 75.	The Elementary Education Act, 1870.	Section four; section five except so far as it defines public school accommodation; section six; sections eight to thirteen; sections fifteen and sixteen; section eighteen from "If at any time" to the end of the section; in section nineteen the words "whether in obedience to any requisition or not"; sections twenty-nine to thirty-four; in section thirty-five the words "a clerk and a treasurer and other" and the words from "but no such appointment" to "member of the board"; sections forty to forty-eight; sections forty-nine to fifty-one; in section fifty-two the words "under the provisions of this Act with respect to the appointment of a body of managers"; sections fifty-three to fifty-six; sections sixty to sixty-six; in section sixty-nine the words "in the metropolis" and the words from "appointed under this Act" to "returns under this Act"; in section seventy-

Session and Chapter.	Short Title.	Extent of Repeal.
33 & 34 Vict. c. 75—*cont.*	The Elementary Education Act, 1870.	three the words "of the school district," the words from "(if any) or if" to "inquiry relates," and the words "or if there is no school board as a debt due from the rating authority"; sections seventy-seven and seventy-nine; sections eighty-seven, eighty-eight, and ninety; section ninety-three; the first proviso of section ninety-seven; the First Schedule; the Second Schedule, except the Third Part; the Third Schedule.
36 & 37 Vict. c. 86.	The Elementary Education Act, 1873.	Sections five to twelve; sections seventeen and eighteen; sections twenty-one and twenty-six; the First Schedule; the Second Schedule; the Third Schedule.
37 & 38 Vict. c. 90.	The Elementary Education (Orders) Act, 1874.	The whole Act.
39 & 40 Vict. c. 79.	The Elementary Education Act, 1876.	Section seven, from "and (2) in every" to "appointing the committee," and the words "and school attendance committee"; in section fifteen the words "not exceeding fifty"; section twenty-one; section twenty-three to "or pay any fees"; section twenty-seven; in section twenty-eight, the words "but subject in the case of a school attendance committee to the approval hereinafter mentioned" and the words "or the officers of the council or guardians by whom the committee are appointed"; sections thirty, thirty-one, thirty-two, thirty-three (except as applied by this Act), and thirty-four; section thirty-six; in section thirty-seven the words "or local authority"; in section thirty-eight the words "or local authority"; and "or school attendance committee"; sections forty-one, forty-two, forty-three, and forty-four; section forty-nine; the Second Schedule; the Third Schedule.
43 & 44 Vict. c. 23.	The Elementary Education Act, 1880.	Section three.
53 & 54 Vict. c. 22.	The Education Code (1890) Act, 1890.	Section one.

Session and Chapter.	Short Title.	Extent of Repeal.
54 & 55 Vict. c. 56.	The Elementary Education Act, 1891.	Sections five, six, and seven.
56 & 57 Vict. c. 42.	The Elementary Education (Blind and Deaf Children), Act, 1893.	Section four from "(*b*) for an area" to the end of the section. Subsections (3) and (4) of section five. Section six.
59 & 60 Vict. c. 16.	The Agricultural Rates Act, 1896.	In section seven the words "a school board for a school district which is a parish or," and subsection (3).
60 & 61 Vict. c. 5.	The Voluntary Schools Act, 1897.	Section one.
60 & 61 Vict. c. 16.	The Elementary Education Act, 1897.	The whole Act.
62 & 63 Vict. c. 32.	The Elementary Education (Defective and Epileptic Children) Act, 1899.	In section six the proviso.
63 & 64 Vict. c. 53	The Elementary Education Act, 1900.	Section three.

NOTE.

The Official revised copy of these Rules was obtained while the book was passing through the press, and when the bulk of it had already been printed, so they are not included in the Contents or List of Appendices on pages 479 and 480.

Session and Chapter.	Short Title.	Extent of Repeal.
54 & 55 Vict. c. 56.	The Elementary Education Act, 1891.	Sections five, six, and seven.
56 & 57 Vict. c. 42.	The Elementary Education (Blind and Deaf Children), Act, 1893.	Section four from "(*b*) for an area" to the end of the section. Subsections (3) and (4) of section five. Section six.
59 & 60 Vict. c. 16.	The Agricultural Rates Act, 1896.	In section seven the words "a school board for a school district which is a parish or," and subsection (3).
60 & 61 Vict. c. 5.	The Voluntary Schools Act, 1897.	Section one.
60 & 61 Vict. c. 16.	The Elementary Education Act, 1897.	The whole Act.
62 & 63 Vict. c. 32.	The Elementary Education (Defective and Epileptic Children) Act, 1899.	In section six the proviso.
63 & 64 Vict. c. 53	The Elementary Education Act, 1900.	Section three.

APPENDIX E.

SCOTCH EDUCATION DEPARTMENT.

RULES

TO BE OBSERVED IN

PLANNING AND FITTING-UP PUBLIC SCHOOLS.

FEBRUARY 1906.

NOTE.—It should be borne in mind that these Rules are only applicable to Scotland. They are given here for the convenience of Scotch readers and for purposes of comparison.

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Appendix E.

SCOTCH EDUCATION DEPARTMENT.

RULES

TO BE OBSERVED IN

PLANNING AND FITTING-UP PUBLIC SCHOOLS.

FEBRUARY 1906.

Prefatory Note.

These Building Rules are intended to show what the Scotch Education Department deem essential in the design and construction of School Buildings and to assist Education Authorities and their Architects to produce satisfactory plans of same.

It will be observed that no reference is made to the nature of the material to be used (stone, brick, &c.), as the selection of this must depend on the particular local circumstances.

The annual cost of maintenance should be kept in view as well as the initial capital expense.

It is desirable that, before instructing an Architect to prepare plans, the number and qualifications of the teaching staff to be employed in the school should be well considered by the Education Authority, as the number of rooms and the accommodation of each will be approximately determined by the arrangements for teaching.

Requirements.

In submitting for the approval of the Scotch Education Department proposals for the erection or enlargement of School Buildings, Education Authorities are requested to note that the following requirements must be complied with, and that inattention to such requirements causes unnecessary correspondence and entails delay:—

I. A Block Plan of the Site, to a scale of 20 feet to an inch. This Plan must indicate—

(*a.*) The position of the School buildings.
(*b.*) Out-buildings.
(*c.*) Playground.
(*d.*) Drains (collateral and main), with their fall and depth below ground.
(*e.*) Entrances.
(*f.*) Boundary walls or fences and adjoining buildings.
(*g.*) Roads.
(*h.*) The points of the compass.
(*i.*) The levels of the ground at the principal points.
(*j.*) The distance and height of adjoining buildings.

N.B.—For approval of site alone, the plan should show (*f.*), (*g.*), (*h.*), (*i.*), and (*j.*).

II. A Plan of each Floor of the School (and Teacher's or Caretaker's Residence, if any) to a scale of 8 feet to an inch. The internal fittings of the rooms (*groups of desks, benches, &c.*) must be accurately shown. The plan should state whether the rooms are intended for boys, girls, or, infants, and also give the number of scholars provided for in each room. In cases of enlargement, plans showing the buildings as they exist must be furnished.

III. Sections and Elevations to a scale of 8 feet to an inch. The ceiling, the positions of window-heads in relation thereto, must be shown on sections, and the methods of ventilation and warming must be shown on plans and sections.

N.B.—(*a.*) The drawings must be drawn in ink on tracing cloth and coloured.

(*b.*) In the case of enlargements or alterations, the whole site and the existing building should be as accurately shown in every respect as the proposed changes, and in such a manner that any change in the number of school places can be readily ascertained.

(*c.*) All plans should be dated, have the scales drawn on, and the dimensions of the rooms figured thereon.

(*d.*) Copies of the plans after they shall have been approved must be furnished for retention by the Department.

IV. A Section of the Desk or Desks proposed to be used, drawn to a scale of $1\frac{1}{2}$ inches to a foot.

V. A Detailed Specification separated under the several branches of the building trade.

VI. A Detailed Estimate of the proposed expenditure, including all outlays which can be foreseen.

N.B.—Revised or amended plans, when submitted, should be accompanied by those formerly considered by the Department.

BUILDING RULES.

Rule 1.—Sites and Playgrounds.

1. The site of every School must be of sufficient area to provide an open, airy playground proportioned to the size and needs of the School, and should, if possible, have a building frontage in proportion to its area. The minimum size of site is, in the absence of exceptional circumstances, a quarter of an acre for every 250 children. If the School is of more than one story, this area may be proportionally reduced, but an unbuilt-on or open space of not less than 30 square feet per child should be preserved.

(*a.*) Except in the case of very small Schools, there should be separate playgrounds for the boys and girls, with separate entrances from the road.

(*b.*) All playgrounds should be fairly square, properly levelled, drained, inclosed, and fitted with some simple appliances. A portion should be covered, having one side against a boundary or division wall. A covered-way should never connect the offices with the main building. Buttresses, corners, and recesses should be avoided.

(*c.*) An Infant School should have its playground on the same level as the School, and a sunny aspect is of special importance.

Rule 2.—Planning.

2. Every School should be planned so that the children can be seated in the best manner for being taught. The accommodation of each room depends not merely on its area, but also on its shape (especially in relation to the kind of desk proposed), and the positions of the windows, doors, and fireplaces. The rooms should be grouped together in a compact and convenient manner, so as to secure proper organisation and effective supervision.

Rule 3.—Central Halls and Corridors.

3. Large Schools to accommodate 500 scholars and upwards should be planned with a Central Hall, with the Class-rooms grouped around it. The Hall must be fully lighted, warmed, and ventilated, and should contain a floor space of about $3\frac{1}{2}$ square feet for each scholar likely to occupy it at one time, but not less than 1,000 square feet in all.

Smaller Schools, if not built with a Central Hall, must have a wide Corridor giving access to the rooms, fully lighted and ventilated, and from 8 to 12 feet wide according to the size of the School.

Rule 4.—School-rooms.

4. A School-room should never be designed to accommodate more than 80 children. The width should be proportioned to the kind of desks used and their arrangement, but in no case should it be less than 16 feet or more than 25 feet. When the number of children to be accommodated in any School exceeds 80, a separate Class-room or Class-rooms as required should be provided in accordance with Rule 5.

(*a.*) No School-room accommodating more than 60 children, having windows on one side only, can be approved. The gable ends should be fully utilised for windows.

Rule 5.—Class-Rooms.

5. Class-rooms should not provide accommodation for more than 60 children.

(*a.*) The minimum size of Class-room allowed is 18 feet by 15 feet, but the proportions should vary with the kind of desks used and their arrangement. A room approximating to a square is the most satisfactory, and a long and narrow room should always be avoided.

(*b.*) The Class-rooms should never be passage-rooms from one part of the building to another, nor from the School-room to the playground. Each should be easily cleared, without disturbance to any other room. Doors should open both ways.

(*c.*) The number of Class-rooms should be sufficient for the size and circumstances of the school. A few of the rooms in pairs may be separated by movable partitions.

Rule 6.—Walls, Floors, and Roofs.

6. The walls of every room used for teaching, *if ceiled at the level of the wall-plate*, must be at least 12 feet high from the level of the floor to the ceiling; if the area exceed 360 square feet, 13 feet, and if more than 600 square feet, then 14 feet high.

(*a.*) The walls of every room used for teaching, *if ceiled to the rafters and collar beam*, must be at least 11 feet high from the floor to the wall-plate, and at least 14 feet to the ceiling across the collar beam.

(*b.*) Great care should be taken to render the roofs impervious to cold and heat.

(*c.*) Roofs open to the apex are not approved. They can only be permitted in Central Halls and Corridors where the roofs are rendered specially impervious to heat and cold, and where apex ventilation is provided.

(*d.*) The whole of the external walls of the School and residence should be solid. *If of brick*, the thickness must be at least one brick and a half; and *if of stone*, at least 20 inches. Special circumstances will be considered by the Department.

(*e.*) In ordinary circumstances, all walls, excepting fence walls, should have an effective damp-proof course just above the ground line.

(*f.*) Central Halls should have wood block or similar flooring.

(*g*.) The vegetable soil within the area of the building should be removed, the whole space covered by a layer of cement concrete not less than 6 inches thick, or a 4-inch layer of broken stones, bricks or ashes, covered with a ½-inch coat of asphalt. Openings should be made in *opposite* walls to ensure a through current of air under floors for ventilation to joists.

Rule 7.—Entrances.

7. Except in very small Schools entrances must be separate for each sex and each department. In large Schools more than one entrance to each department is desirable. The principal entrances should never be through the cloak-room, or directly into the School-room or Class-room. Entrance doors and the doors of School and Class rooms should open outwards as well as inwards. An external door, having outside steps, should have a landing or plat between the door and the steps. If entrances are directly opposite each other they should have internal porches.

Rule 8.—Cloak-Rooms and Lavatories.

8. Cloak-rooms should not be passages, and should be external to the School-rooms and Class-rooms, with gangways at least 4 feet wide between the hanging-rails, and amply lighted. The hanging-rails should be arranged so that the children can enter and leave the cloak-room without confusion or crowding. In large Schools there should be separate ingress and egress. Hat-pegs should be 12 inches apart, numbered, and of two tiers at suitable heights. The hanging-space necessary to provide a separate peg for each child is thus 6 inches lineal.

Thorough ventilation is essential, so that smells may not be carried into the School. Where practicable, it is desirable that provision should be made for warming the cloak-rooms.

Lavatory basins should be provided in the proportion of one for each twenty-five scholars, and should be placed against an external wall. They should, if practicable, have a continuous flow of water, in and out.

A cleaner's slop sink, with water supply and a cupboard, should be provided on each floor of the School.

Rule 9.—Windows.

9. Every part and corner of a School should be fully lighted. The light should, as far as possible, and especially in Class-rooms, be admitted from the left side of the scholars. Where left light is impossible, right light is next best. Other windows should be provided for ventilation where possible, but they should be subordinate so far as the lighting is concerned. Windows full in the eyes of teachers or scholars should be specially avoided. In rooms of a height of 14 feet or under, any space beyond 25 feet from the window-wall cannot be regarded as sufficiently lighted.

(*a*.) Windows should never be provided for the sake merely of external effect. All kinds of glazing which diminish the light and are troublesome to

keep clean and in repair should be avoided. A large portion of each window should be made to open for ventilation and for cleaning.

(*b.*) The sills of the main lighting windows should be placed about $3\frac{1}{2}$ feet and not more than 4 feet above the floor, and the lintels should be as close to the ceiling as is practicable. Large spaces between the window heads and the ceiling are productive of foul rooms. The upper sashes should be hinged to fall inwards and form a hopper with side cheeks for summer ventilation.

(*c.*) In each Class-room the glass area should be from $\frac{1}{4}$ to $\frac{1}{5}$ the area of the floor, and should not be less than $\frac{1}{6}$.

(*d.*) Skylights are objectionable and will only be allowed in the case of Central Halls or Corridors having ridge, or apex, ventilation.

(*e.*) The colouring of the walls and ceilings and of all fittings in the rooms should be carefully considered as affecting the light. This point and the size and position of the windows are especially important in their bearing on the eyesight of both teachers and scholars.

(*f.*) Suitable blinds must be provided where necessary.

Rule 10.—Staircases.

10. A staircase must be fire-proof, external to the Hall or Rooms, but as far as possible visible from the Hall. No triangular steps or "winders" should be used. Each step should be not less than 12 inches broad and not more than $5\frac{1}{2}$ to 6 inches high. The flight should be short, and the landings unbroken by steps. The number of staircases should be sufficient, not only for daily use, but also for rapid exit in case of fire or panic. Separate staircases must be provided for each sex.

Rule 11.—Ventilation.

11. The principal point in all ventilation is to prevent stagnant air. Apart from opening windows there must be provision for copious inlet of fresh air; also for outlet of vitiated air at the highest point of the room. A satisfactory way of providing the latter is to build to each room a separate air-flûe carried up in the same stack with smoke flues. An outlet should have motive power by heat or exhaust, otherwise it will frequently act as a cold inlet.

Inlets are best placed in corners of rooms furthest from doors and fireplaces, and should be arranged to discharge upwards into the rooms. Gratings in floors should never be provided. Inlets should provide a *minimum* of 6 square inches of net air-way per child, and outlets a *minimum* of 4 inches. All inlets and outlets should be in direct communication with the external air. Besides being continuously ventilated by the means above described, rooms should, as often as possible, be flushed with fresh air admitted through open windows and doors.

Sunshine is of particular importance in its effects on ventilation and also on the health of children.

Rule 12.—Warming.

12. The heat should be moderate and evenly distributed, so as to maintain a temperature of from 56° to 60° Fahrenheit. If the corridors and lobbies are warmed, the rooms are more easily dealt with and are less liable to cold draughts.

Where Schools are warmed by hot water the low pressure system and the principle of direct radiation are recommended. In such cases open grates in addition are useful for extra warming on occasions, and their flues for ventilation always.

(*a.*) A common stove, with a pipe through the wall or roof, can under no circumstances be allowed. Stoves are only approved, when (i.) provided with proper chimneys (as in the case of open fires); (ii.) of such a pattern that they cannot become red-hot, or otherwise contaminate the air; (iii.) supplied with fresh air, direct from the outside, by a flue of not less than 72 inches superficial, and (iv.) not of such a size or shape as to interfere with the floor space necessary for teaching purposes.

(*b.*) Open grates should be of the ventilating pattern, having an air-chamber with fresh air inlet direct from the outside, and openings from same having regulating valves or sliding gratings for delivering the warmed air into the rooms. Proper means of access for the purpose of cleaning the air-chambers should be provided.

(*c.*) Fireplaces and stoves should be protected by fireguards.

(*d.*) A thermometer should always be kept hung up in each room of a School.

RULE 13.—SANITARY ARRANGEMENTS.

13. Water-closets within the main School building are not desirable, and should only be provided for teachers. All others should be at a short distance and completely disconnected from the School. Single closets of the wash-down pattern are preferable to the trough system.

(*a.*) The doors leading from the School to the latrines, and the latrines themselves, must be separate for the two sexes.

(*b.*) Each closet must be not less in the clear than 2 feet 3 inches wide nor more than 3 feet, *fully lighted and ventilated*, and supplied with a door, cut 4 inches short at top and bottom.

There must not be more than one seat in any closet.

(*c.*) The children must not be obliged to pass in front of the teacher's residence in order to reach their latrines.

(*d.*) The following table shows approximately the number of closets needed:—

	For Girls, or for Girls and Infants.	For Boys.	For Infants.
Under 30 children -	2	1	2
,, 50 ,, -	3	2	3
,, 70 ,, -	4	2	3
,, 100 ,, -	5	3	4
,, 150 ,, -	6	3	5
,, 200 ,, -	7	4	6
,, 300 ,, -	8	5	7

(*e.*) There should be a urinal channel in the proportion of 10 feet lineal per 100 boys, and a sufficient supply of water for flushing same provided, as well as the necessary drains.

(*f.*) Cesspits and privies should only be used where unavoidable, and should be at a distance of at least 20 feet from the School. Earth or ash closets of an approved type may be employed in rural districts.

(*g.*) Soil-drains should always be laid outside the building (on a hard even bottom of concrete) in straight lines, with glazed stoneware or fireclay pipes; carefully jointed in cement and made absolutely watertight. A diameter of 4 inches is sufficient, except for drains receiving the discharge of more than 10 closets. Above this number the diameter should be 6 inches. The fall should be 1 in 30 for 4-inch, and 1 in 40 for 6-inch drains. An inspection opening or chamber should be provided at each change of direction, so as to facilitate cleansing the drain without opening the ground. Every drain must be disconnected from the main sewer by a properly constructed trap. This trap must be thoroughly ventilated by at least two openings; one being the 4-inch soil pipe carried up full size above the roof, and the other an inlet pipe connected with the side of the trap furthest from the public sewer. Automatic flushing tanks are desirable where trough closets are used. In the case of soil drains inside the building, should such be unavoidable, they should be constructed with heavy cast iron pipes, carefully caulked and jointed with lead, and having concrete blocks under the faucets.

(*h.*) Waste pipes from sinks or lavatories should be first trapped inside, and then made to discharge direct through an outer wall over a trapped gully.

Rule 14.—Water Supply.

14. All Schools should be provided with an adequate supply of wholesome drinking water.

In cases where there is no public supply in the district, care must be taken to ascertain that the supply proposed to be adopted is adequate in quantity, is of suitable character, and is not liable to pollution in any way, as *e.g.*, by surface drainage, or by leakage from sewers, drains, cesspools, or other receptacles.

All water pipes should be properly protected from frost, and so laid or fixed that in the event of their becoming unsound the water conveyed in such pipes will not be liable to become polluted or to escape without observation.

There should be no direct communication between any pipe or cistern from which water is drawn for domestic purposes, and any water-closet or urinal.

All water-closets and urinals should be provided with proper service cisterns, which, together with the outlet therefrom, should be capable of providing a sufficient flush.

Any cistern to be used for the storage of water should be properly covered and ventilated, and so placed and constructed that the interior thereof may be readily inspected and cleansed.

Rule 15.—Desks.

15. Seats and desks, graduated according to the ages of the children, should be provided for all the scholars, and placed at right angles to the windows. The seats should be fitted with backs, and they should rise from front to back by the

floor under them being made stepped, the front steps being shallow, and the steps increasing in height to maximum of 4½ inches at the back.

An allowance of at least 18 inches per scholar at each desk and seat should be made (except in the case of the dual desk) and the length of each group should therefore be some multiple of 18 inches, with gangways of 18 inches between the groups and at the walls. A desk for one child needs no gangway next the wall. In the case of the dual desk the length should be 3 feet 4 inches for the higher standards, 3 feet for the lower, and 2 feet 6 inches for the youngest infants, and the gangways 1 foot 4 inches.

(*a.*) The desks should be inclined at an angle of 15°. Flat desks have a tendency to make the children stoop. A raised ledge in front of a desk interferes with the arm in writing. The edge of the desk when used for writing should be vertically over the edge of the seat.

(*b.*) No desks should be more than 9 feet long. In a School-room providing for more than 60 children there should not be more than four rows of long desks, or five rows of dual desks. In an ordinary Class-room five rows of long desks, or six rows of dual desks, may be provided.

Long desks must be so arranged that the teacher can pass between the rows. Where dual desks are used this is not necessary, as the gangways give sufficient access, but the teacher should be able to pass behind the back row.

Rule 16.—Accommodation.

16. The accommodation of a School is based upon the number of children who can be seated at the desks, arranged in accordance with Rule 15, provided that a minimum of 10 square feet of floor space per child is obtained.*

A Central Hall will not be counted in the accommodation, nor will a Class-room for Cookery, Laundry, Manual Instruction, Drawing, or Science.

Rule 17.—Infant Schools.

17. Infants should not, except in very small Schools, be taught in the same room with older children, as the methods of instruction suitable for infants disturb and injuriously affect the discipline and instruction of the other children. Access to the Infants' Room should never be through a room in which older children are taught.

(*a.*) There must be no opening other than an ordinary doorway between an Infants' Room and any room occupied by older children, and the partitions between such rooms should be impervious to sound.

(*b.*) An Infant School should always be on the ground floor.

(*c.*) No Infants' School-room should accommodate more than 80 infants, nor an Infants' Class-room more than 50. They should be well lighted from the side. The light for object-lessons is as good from the right as from the left. When the number of infants to be accommodated exceeds 80, a separate Class-room or Class-rooms as required should be provided in conformity with Rule 5.

* Note.—While this represents the *minimum* amount of floor space that can be recognised as sufficient, it is desirable that a larger area should always be provided wherever practicable.

(*d.*) The width of an Infants' Room should be in proportion to its size, but not less than 16 feet. A space in which the children can march and exercise should be provided, if no Central Hall is available.

(*e.*) An Infant School should have suitable seats and desks for the use of the older infants and low kindergarten desks for the babies and younger infants, placed on a stepped gallery, as described in Rule 15. An allowance of 16 inches per child at long desks will be sufficient.

Rule 18.—Rooms for Cookery, Manual Instruction, Science, &c.

18. As a rule a single room for Cookery, or Laundry Work, or Manual Instruction, or Science, or Drawing, will serve for more than one School if provided as a Centre in a convenient position. Every such Centre should have its own lavatory and cloak-room.

Large Schools, or Schools of an exceptional type, may sometimes require special rooms for their exclusive use.

(*a.*) *Cookery.*—A Cookery-room should be capable of accommodating 12 to 18 at practice or 36 to 54 at demonstration at any one time. The larger size will require 750 superficial feet and 10,500 cubic feet. Provision for instruction in scullery work is necessary.

The sink should be placed in full view of the teacher and children, and should be fitted with a cold water supply and a waste pipe.

There should also be a gallery or raised platform with desks to accommodate 36 to 54 children, according to the size of the room.

The floor space for practical work should afford about 20 square feet for each scholar, and should not be encumbered with desks, cupboards, or stoves.

Cookery-rooms should be cut off by a ventilated lobby from the rest of the School, and the ventilation needs special arrangements. Where a gas stove is used, it may be necessary to have a canopy and pipe fixed over same to carry off noxious fumes. The temperature of the room should not be allowed to rise above 70° Fahrenheit.

The apparatus for lessons in Cookery should include such stoves and other appliances as are usually found in the homes of the children.

(*b.*) *Laundry Work.*—A Laundry should be of simple construction, and, if provided as a Centre, entirely apart from the ordinary School buildings.

The proper size for a Laundry is about 750 square feet. It should have a gallery or raised platform with desks for 42 children.

Laundry tables should be large enough to allow at least three feet lineal of space for each child when ironing.

The ventilation of rooms for Laundry-work needs special arrangements for the removal of steam.

In small Schools a room for Cookery and Laundry Work combined may be approved.

(*c.*) *Manual Instruction.*—In its plan, arrangements, construction, lighting and ventilation, a Manual Instruction room should be modelled on a workshop

rather than on a School. The construction should accordingly be simple. The roof may be either of lean-to or other ordinary form, according to circumstances. Its height at the windows in front of the benches need not be more than 10 feet. The light must be ample. The temperature should not be so high as in an ordinary Class-room. A flat ceiling is not, as a rule, necessary. Ample ventilation should be provided by inlets at a height of 5 feet from the floor, and by outlets at the highest point. A Manual Instruction room of 20 scholars should have a floor space of about 700 square feet.

(*d.*) *Science Room.*—A room suitably fitted for elementary practical work in Science may be provided for the use of one large or several contributory Schools. Such a Science-room should, as a rule, contain not less than 600 square feet of floor space. It should be fitted with strong and plain tables, sinks, cupboards, and shelves, and where necessary, a fume closet. A proper supply of gas is necessary.

In addition to a Science-room, one of the ordinary Class-rooms may be fitted with a simple demonstration-table and gas and water supply. A special Lecture-room cannot be approved in an ordinary public Elementary School.

(*e.*) *Drawing Class-rooms.*—A Drawing Class-room can only be sanctioned where it is likely to be used for a reasonable time every week by the scholars from one large or several contributory schools. A suitable size for such a room is 600 square feet of floor space. Light should be admitted at a suitable height and angle from the north, north-east, or east. The whole available wall space of the room from a height of about 3 feet above the floor up to a height of about 7 feet from the floor should be covered with linoleum or have the surface suitably prepared for the purpose of chalk drawing. Where no special Drawing Class-room is provided, the walls of at least one of the ordinary Class-rooms should be prepared as above described.

(*f.*) *Rooms for Continuation Class Work.*—When a large Elementary School is being erected, in a district likely to become a Centre for a considerable amount of evening Continuation Class-work of a scientific character (Building Construction, Engineering, and the like), the provision of a Physical Laboratory and Manual Instruction Workshop should be kept in view. One or two rooms should also be specially furnished with flat-topped Drawing-desks of a height suitable for adults, for the purposes of Mechanical Drawing.

RULE 19.—HIGHER GRADE SCHOOLS.

19. For a Higher Grade School accommodating from 300 to 350 scholars, 10 Class-rooms will generally be required, since every class should have its own Class-room.

(*a.*)—(i.) The Class-rooms may be furnished with single or dual desks as may be desired. Single desks should be 2 feet long, arranged in pairs with intervals of 2 inches and gangways 2 feet wide between each pair and 18 inches at the walls.

(ii.) If single desks are adopted, a Class-room should have an area of about 16 square feet per scholar. Class-rooms fitted with dual desks need not be so large, but a minimum of 13 square feet per scholar will be required.

(*b.*) Every Higher Grade School should be provided with suitable Laboratories.

(i.) The Laboratory accommodation must be sufficient to provide at one time for the largest class in the School.

(ii.) There should generally be one Laboratory for Chemistry and one for Physics, but where the teaching staff does not admit of separate Laboratories being provided, one room may be made to serve for both Chemistry and Physics.

(iii.) The Laboratory should afford 30 square feet of floor space for each scholar. The minimum size will therefore be 600 square feet, but it is as a rule desirable that the Laboratory should be somewhat larger.

(iv.) Laboratories must be fitted with suitable tables, which must be well lighted; they should be properly supplied with gas and water. For Chemical Laboratories, sinks, cupboards, and the necessary fume closets, must be provided.

(v.) A small balance-room may be provided if desired.

(*c.*)—(i.) In addition to the Class-rooms and Laboratories a Higher Grade School may include a Lecture-room, which should be fitted with (1) a demonstration-table furnished with a gas and water supply and a sink, and (2) a fume closet. A Lecture-room should have an area of about 750 square feet.

(ii.) If no separate Lecture-room is provided, each of the Class-rooms used by the third and fourth year Scholars should be fitted with a simple demonstration-table.

(iii.) A small preparation room, fitted with bench, sink, cupboard, and shelves, and proper supply of gas should be provided in a convenient position.

(*d.*) A Drawing Class-room for the more advanced Drawing is desirable. It should provide 30 square feet of floor space for each scholar; the best size will be a room with an area of 750 square feet. If suitably lighted, the Hall would answer for this purpose. The walls should have a portion of the surface prepared for chalk drawing (see Rule 18, *e*).

(*e.*) Where other special rooms for Cookery, Laundry-work, and Manual Instruction are required, these should be provided in accordance with the instructions in Rule 18.

(*f.*) A Higher Grade School should be planned with a Central Hall; but no class, other than Drawing, can be recognised in such a hall.

Rule 20.—Teacher's House, Etc.

20. The residence for the Master or Mistress should contain a parlour, a kitchen, a scullery, pantry and store closet, three bedrooms, a bathroom and W.C., and the smallest dimensions which the Department can approve are :—

For the parlour - -	14 ft. by 12 ft.	of superficial area	9 ft. in height to wall-plate
„ „ kitchen - -	12 ft. by 12 ft.		9 ft.
„ one of the bedrooms	14 ft. by 12 ft.		8 ft. if ceiled at wall-plate ; or 7 ft. to wall-plate, and 9 ft. to ceiling.
„ two other bedrooms	12 ft. by 8 ft.		

(*a.*) The residence must be so planned that no room is a passage room.

(*b.*) There must be no internal communication between the School and the residence, and the latter should not be built as part of the school.

(*c.*) Windows should be carried up as nearly to the ceiling as practicable.

(*d.*) There must be a separate and distinct yard with offices.

(*e.*) A caretaker's house should be similar to the above but with one bedroom less.

Rule 21.—Teachers' Rooms.

21. In large Schools rooms should be provided for the use of the Head Master and Teachers, with suitable lavatory accommodation. In small Schools, one room may serve for both Male and Female Teachers. A store-room for books and other School material should adjoin the Teachers' room.

Rule 22, 23, & 24.—Cost and Loans.

22. The Department may refuse to sanction and the Public Works Loan Commissioners may decline to grant a loan of money unless the whole cost of the School, exclusive of site, legal expenses, extra rooms for instruction authorised by the Code, and residence (if any), is kept with the sum of £12 per child accommodated. Additional allowances over the above limit will be made in respect of the cost of a Central Hall and in respect of rooms for extra subjects recognised by the Code, such as Drawing, Chemistry, Cookery, &c., varying from 15s. to 20s. per square foot, and for workshops, from 10s. to 15s. per square foot. Expenditure not exceeding £800 and £500 will be allowed for a Master's and a Caretaker's house respectively. Whether the necessary loan be borrowed in the open market or not, extravagant plans cannot be approved, and the actual tenders received must be submitted along with application for Loan.

The period proposed for repayment of a loan should not, as a general rule, exceed 40 years for new buildings, and 30 years for enlargements.

23. The Department do not entertain applications for loans in respect of expenditure incurred without their previous sanction. Applications for loans should therefore include all the items in the first instance. The attention of School Boards is specially directed to this Rule. Disregard of it may lead to the necessity of having to meet any unsanctioned expenditure from current income.

24. In order to secure due economy and the avoidance of confusion at completion, all building contracts should contain a clause that no claim for extras will be even considered, unless the work has been ordered in writing by the Architect, and the order bears the counter-signature of the Clerk of the School Board. A Provisional Sum not exceeding 5 per cent. on the cost or a total sum of £300, whichever is the lesser amount, may—if considered desirable—be added to the total amount of the tenders to cover unforeseen contingencies.

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